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THE TREATMENT OF PULMONARY CONSUMPTION.

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THE TREATMENT

OF

PULMONARY CONSUMPTION

A PRACTICAL MANUAL

BY

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"De aëre, cibo, potu, pathematis animi reliquisq; quæ ad Ægri regimen pertinent, peritum Medicum, pari industriâ, ac de medicamentis ipsis in hoc morbo consulere oportet. Absq. enim cauto istorum regimine, atq; usu, vel generosissima remedia in Phthiseos curatione nihil prosunt."—(*Morton's "Phthisiologia," 1689, Ch. viii., p.* 167.)

PREFACE.

In undertaking to write a book upon the Treatment of Pulmonary Consumption, the authors have been encouraged by the fact that the knowledge of the subject is ever progressive. With increase of information as to the pathology of tuberculosis in general, and of pulmonary consumption in particular, our perception of the conditions under which the disease arises becomes clearer, and the question of its treatment requires of necessity, from time to time, to be reconsidered.

The present work claims to be a fairly full review, at the time of writing, of the subject of which it treats. For the opinions expressed, the writers have separately and together collated and compared the published works of previous observers, and have endeavoured to put forward only such views as seemed to them to be reasonable and in accord with their own somewhat extensive experience of the disease. They have endeavoured also to steer between the fatal *non possumus* on the one hand, and the equally dangerous opinion on the other, that the most recently introduced method of treatment or the most widely advertised drug is the specific for consumption. They have tried to bring into agreement—not always an

easy task—the teachings of physiology and the lessons of clinical experience, preferring to base their conclusions as far as possible upon bedside facts rather than upon attractive theories.

To their present Colleagues and to the many generations of previous workers at the Victoria Park Hospital, and especially to the Pathologists, the authors are under great obligation for the immense and valuable record of clinical and pathological experience to which they have had free access.

LONDON.

November, 1895.

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ERRATUM.

P. 96, line 17, *for* Dr. Hughes Bennett *read* Dr. Henry Bennet.

THE TREATMENT

OF

PULMONARY CONSUMPTION.

CHAPTER I.

HISTORY OF THE TREATMENT OF PULMONARY CONSUMPTION.

Phthisis pulmonum, wasting of the lungs, or more commonly "Consumption," is a condition which has been recognized and described from a very early period of medical history to the present time, and has been the subject of ardent and interminable controversy, both as to its nature and as to its treatment in every language of the civilized world. The older writers, untrammelled by the bonds of precise pathological or microscopical knowledge, put forth their various theories as to the causation and origin of the disease in the dogmatic fashion of their day, and founded various lines of treatment upon them. In the summary of the progress of knowledge on the subject which follows it will be seen how near to the right path many of the older writers attained, and how very little the chief ideas of treatment have altered during the lapse of centuries.

Although the true pathology of the disease was practically unknown, the clinical features of consumption were almost as fully recognized in the early days of medicine as they are at the present moment, although called by different names, and ascribed to different causes. The coarser pathological lesions were described but not understood. Pathological knowledge was limited to the pene-

trative power of the naked eye, later on assisted by the simple lens, and hence in their attempts to explain the early changes which had led to the results before them, the older writers had perforce to make use of theory, or, in other words, to draw upon the imagination for the explanation of the actual processes going on in the tissues. The influence of the human imagination has indeed been the great stumbling-block in the road of true pathological advance from the earliest times to the present. Many of the so-called facts of pathology, if traced to their source, may be found to have been originated in the dictum of some authoritative writer of a bygone time, whose reputation had been such as to blind his pupils to the fact that he had taught them what he believed, but not what he actually knew. Thus in the study of phthisis we find the steady current of knowledge constantly turned aside by teachings of this kind, many of them causing a veritable flood of fallacy, the traces of which have remained for generations.

In his work, "A Practical and Historical Treatise on Consumptive Diseases, deduced from Original Observations and collected from Authors of all Ages," published in 1815, Dr. Thomas Young, a Fellow of the Royal College of Physicians and Physician to St. George's Hospital, devoted much time and labour to the collation of the works of all writers upon the subject, and to it we may refer for a confirmation of the foregoing remarks, acknowledging at the same time our indebtedness to it for much that follows. Nothing is more remarkable in the perusal of such a retrospect as that of Dr. Young, than the frequent absence of any effort on the part of very many of the earlier writers to bring any material evidence to bear in support of their pathological theories, even where such evidence must have been well within

their grasp. The records of treatment, upon which the chief stress was laid by all writers of the later middle ages, contain indications showing that almost every modern remedy or method of treatment has been forestalled by something analogous to it, at some period of the history of pulmonary consumption. Most of the therapeutic theories, too, have had supporters from time to time, no less enthusiastic, and sometimes no less blinded by enthusiasm, than those of a more recent period.

To the mind of Hippocrates, phthisis presented itself as a disease characterized by ulceration and destruction of the lungs, associated with crude tumours or swellings, generally of a nodular form.

The widespread destruction found in some cases was regarded as the result of "matter which descended from the head and corroded the lungs." The tubercles or nodosities were caused by putrefaction of retained secretions, bile, mucus, and the like. The bleeding of the lungs was caused by ulcerations or rupture of the varicose vessels within them. The blood that was not expectorated remained in the lungs and "turned to pus." The disease was sometimes thought to be produced by effusion of blood into the pulmonary tissue, which became purulent without any appearance of hæmoptysis to indicate its presence. Empyema was recognized, but probably in many cases confused with phthisis. It was essentially regarded as an intrathoracic abscess, and one of the principal objects of treatment was to cause it to burst into the lung. The classical Hippocratic "succussion" was thus used, not only as a means of diagnosis, but also as a terribly practical method of treatment. Paracentesis was only employed after the patient had been "well shaken," with this object. The aspect of a

consumptive patient and the chief symptoms of his disease were perhaps nearly as well known to Hippocrates and to those who followed him as they are to the specialist of to-day. The recognized physical signs of the disease were few in number, and much stress was laid upon such points as the sinking of nummular sputa in salt water, etc. It was thought that treatment should be excretory in its effects, and that the morbid material should be cleared out of the body by some means or other; hence the use of emetics, purges, issues, and bleedings was strongly advocated. The possibility of infection as a means of the dissemination of phthisis was discussed at a very early period of history, and appears in the works of Aristotle (shortly after the time of Hippocrates) in the suggestion that the foul breath of a consumptive might convey the disease to a healthy person. The value of a milk diet and the beneficial effects of sea-voyages were insisted on by Arytæus, a writer of the same period. He affirms that the saline particles in the sea air "dry up the ulcers" in the lungs. He notes, too, the cheerful disposition of phthisical patients even when at their worst. Celsus speaks of the advantages of the voyage to Alexandria, but disagrees with other authorities of his day as to the use of exercise, believing extremes of heat and cold and exertion to be harmful. In the works of Pliny appears the first suggestion of an idea which has been put to so many uses, commercial and otherwise, since his day, viz., the belief that the exhalation of resinous effluvia from pine trees possesses some healing virtues in cases of phthisis.

In the voluminous writings of Galen the treatment of phthisis and hectic fever is accorded a large share of attention, but no material advance was made either by him or his immediate followers towards a better under-

standing of the real nature of the disease. He was sceptical, as so many others have been in their turn, as to the value of hæmoptysis as a positive symptom of lung disease, considering discharge of blood from the fauces to be not a rare occurrence. A thorough advocate of the use of milk as a diet, he emphasized the necessity of obtaining it fresh from the animal, and confirmed the notion put forward by previous writers that human milk drawn direct from the breast was the best of all foods for the consumptive. The use of inhalations for the relief of laryngeal ulceration was hinted at, but chiefly for the application of astringent vapours. The directions for treatment given in Galen's work are numerous, and in some cases appear fanciful, but a very significant proviso is attached to many of them to the effect that success depended upon their early application.

The train of ideas which would seem to have led up to the suggestion of many of the early remedies accord with singular precision with some of the so-called therapeutic advances of recent times. Thus the antipyretic treatment of phthisis was advocated as long ago as the latter end of the seventeenth century by Poterius, a physician attached to the French Court of that day, in the form of an "antithectic," which we are told was a chemical compound. Intra-pulmonary injections were made prior to the year 1700. In 1726 a successful attempt was made by Barry, of Dublin, to open and drain an apical cavity in the lung, but this example was but rarely followed, the next recorded case of the kind being nearly 120 years later. Carbonic acid vapour was used as a specific in 1774, while medicated vapours in an enclosed space had been employed 100 years previously by Bartholin, who maintained that a sitting-room might be made, by proper effluvia, to "serve instead of a voyage to Egypt."

Koumiss, which has since been brought forward at irregular intervals as a new remedy, was in use a century ago. Such instances might be multiplied indefinitely.

Some of the modern theories too—such as those relating to the contagiousness of phthisis, and its dependence upon the presence of some subtle poison—were often present to the minds of the ancient writers and those of the middle ages. The fear of contagious and accidental inoculation was very prevalent about the middle of the eighteenth century, and there can be no doubt that the study of pathology suffered much from this cause In the writings of several physicians about the time of Morgagni there are many indications that post-mortem examinations in cases of tuberculosis were looked upon as dangerous.

The fears of physicians had probably spread to the general public in Italy, since it is recorded by Borsieri in 1782 that "the College of Physicians in Tuscany decided against the contagiousness of phthisis, but were not able to convince the Government of the inutility of precautions."

The idea of a foreign parasite appears in 1733 in the works of a French writer, who thought that both scrofula and consumption were contagious, "the putrefaction breeding worms which propagate the disease and cause it to spread."

Thus it will be seen that although opinions were held and methods practised which subsequent events have shown to have been in the main correct, there was nevertheless confusion in the current knowledge of the disease as a whole. From time to time, however, the greater minds brought together the scattered truths, and towards the end of the eighteenth century had established the clinical knowledge of the disease on a firm and consistent

footing, and added much to the recognition of its etiology. The exercise of common sense in treatment in the place of routine and superstition became still more marked. An observation by Dr. Rush, written in 1793, on the value of climatic treatment, gives a pregnant example of this. He says: "A change of climate must not be expected to produce its full effect in less than two years. A medical attendant should accompany the patient if possible to prevent his losing time in the pursuit of all sorts of remedies which will be recommended to him."

The ideas of treatment prevalent between the beginning and the middle of the present century were mainly those of Laennec, who recognized the inutility of specific drugs to cure consumption, and the value of maintaining the strength and general vigour of the patient, without much reference to the condition of his lungs. He repudiated too the old derivative and resolvent ideas of the ancients, supplemented and oftentimes confused, as they had been, by fanciful methods, based upon a purely imaginary pathology, and supported by exaggeration of all favourable results and complacent disregard of obvious drawbacks.

During the last 30 years a great change has come over the general practice with regard to this question, not so much in respect of new remedies, although their name has been legion, but as regards the main proposition that the treatment of the patient is of more practical value than the treatment of the disease itself.

The presence of the tubercular disease in the lung having been recognized, the effort of modern times has been directed not so much towards the softening, removal, or absorption of the morbid product as to the maintenance of the general vigour of the patient, with the sole object of rendering his tissues sufficiently healthy to withstand

the invasion of the tubercular process. Side by side with this object, however, efforts have more recently been made to find some substance which, being introduced into the general circulation, shall act as an antagonist to the micro-organisms concerned in the disease. It is sufficient to say that no such substance has as yet been found, but the results obtained in some of the efforts to find it cannot be disregarded in the practical handling of the disease, and hence some of the antiseptic remedies which have been used with this object have come to be credited with a certain amount of beneficial action, and have found a place in the list of remedies in common use. The results so obtained must be taken for what they are worth, and it must be clearly recognized that the use of such remedies at present is purely empirical. No rational explanation of their action can be given which would stand the test of scientific investigation.

This brief sketch would be incomplete without mention of two plans of treatment which have been recommended within the last few years. We shall deal more at length with them in a later chapter (viz., Chapter X.), first the method of injection into the consumptive of active principles or "toxines" extracted from the culture media, in which certain micro-organisms (which we shall see in Chapter III. have been proved to be the actual exciting cause of the lesions of consumption) have been grown. The first attempt in this direction was with a substance called "tuberculin," and was advocated by Prof. Koch. This method of injection treatment was for a short time considered to be almost infallible in certain cases, but it soon passed into disrepute and is now never, or at any rate hardly ever, used for the purpose of treatment. Its introduction, however, must be looked upon as highly important, as it marked the first step in what must

be thought a scientific method of attacking the tubercular process itself. The second method, which must be briefly alluded to, is that of the so-called "*antitoxic serum*" method of treatment. It consists of the injection into the diseased, of the serum obtained from the blood of animals either naturally or artificially immune to, *i.e.*, insusceptible of consumption. This method has not yet had an extended trial, and there are serious and practical difficulties about its employment. It is, however, a plan which should be remembered, since the treatment of other diseases, *e.g.*, diphtheria, upon a similar principle has been distinctly encouraging.

CHAPTER II.

HISTORY OF THE PATHOLOGY OF PULMONARY CONSUMPTION.

ALTHOUGH, as we have seen in the previous chapter, considerable knowledge existed of a disease or group of diseases classed under the head of consumption, and although guesses, not so far removed from the truth, were made as to the conditions under which this affection was set up, no real attempt was made to investigate its pathology. All the theories as to the nature of the disease were based upon scant observation of the morbid anatomy, and the treatment was, therefore, of necessity theoretical, if not fantastic. There is not perhaps anything surprising in this, seeing that the knowledge of the natural processes of the body was of the most fragmentary and insufficient kind. As time went on it is possible to trace an increasing knowledge of some of the grosser facts of anatomy, but it was not until the seventeenth century that we find the commencement of the modern science of physiology. The discovery of the circulation of the blood by Harvey marks indeed an epoch, the importance of which cannot be over-estimated from the point of view of modern science. It formed a sound basis for further researches and solved once and for all many questions in connection with the natural processes of the body, the answers to which had been previously exceedingly meagre. Following in the wake of Harvey were several investigators after his own stamp, such as Glisson, Wharton, and Willis, each of whom contributed important facts to

the province of anatomy or physiology, and whose names are still connected with such discoveries. It was not, however, until almost the end of the century that we find much evidence that the study of pathology had gone on *pari passu* with that of the sister science of physiology, and then it is remarkable that any one man should have been able to make such a great advance as did Morton. His knowledge of the morbid anatomy of phthisis must have been extraordinary, and his views as to the pathology of the affection were so reasonable as to withstand almost a century of criticism.

Morton laid it down that the phthisical process mainly consists of induration of the lung and the formation of tubercles, and that a very close relation exists between scrofula and phthisis. He went even beyond this, and described no less than fourteen different varieties of phthisis, to all of which hectic fever was a common symptom. It may reasonably be supposed that some of these varieties were merely varying degrees of septic infection. Portal, following Morton, regarded tubercles as scrofulous tumours in the lungs, and believed that the indurative process was a secondary result of the irritation set up by their softening products.

Baillie in 1793 taught that miliary tubercles might be converted into "abscesses," after having been aggregated into masses which softened in the centre.

Vetter, in 1803, declared that the softening was always preceded by a caseous change in the tubercular masses. Confusion and controversy had arisen as to the relative parts played by inflammation and degeneration, but Vetter was clearly of opinion that the indurative process was inflammatory, and that the so-called "abscess formation" was purely degenerative in its nature. Another point in the pathology of the disease was much discussed

about the same time, viz., whether tubercle and scrofula were identical, but no conclusion appears to have been arrived at.

Bayle, writing in 1809, attempted another pathological classification of phthisis. He distinguished between tough miliary tubercle and the granular nodule, the latter of which he held was capable of complete absorption. In other words, he recognized the tubercular nature of infiltration, although he did not regard general infiltration as specific. He reverted to the older views of cavity formation, looking upon the process of softening as inflammatory. It should be recollected that the non-vascular nature of tubercle had not yet been established.

Much as these observers had done in the direction of describing the different lesions met with on post-mortem examination in cases of phthisis, and correct as had been some of their conclusions as to the nature of the tubercular processes, it fell to Laennec, in 1811, to bring together and appraise at their relative value the facts and theories which had been accumulating up to his time, and the result of his labours was such that many of his dicta and much of his teaching are accepted as correct at the present day. In the first place he showed that the elaborate classifications of his predecessors were misleading, in that they described as distinct varieties of disease what were in reality but different stages of the same morbid process, or slightly different manifestations of the same morbid action. In the second place, he showed that certain affections of the lungs had been classed as phthisis, or even as tubercle, which had nothing in common with tubercular phthisis "except that they had their seat in the same organ." Of such were "melanosis" and "cancer" of the lung. In fact, to summarize his view, we may say that he taught that phthisis pulmonalis is

due to development of tubercles in the lung tissue, these tubercles being a peculiar species of accidental production, occurring either in the form of isolated bodies or of interstitial deposits, the former capable of amalgamation to form yellow masses, in the centre of which softening might take place, the evacuation of the softened material being followed by cavities or vomicæ in the lung tissue. Vomicæ, which had up to his time been considered to be "ulcers of the lungs," he rightly designated "tuberculous excavations." The thickening round about such excavations Laennec declared was of tuberculous and not of mere inflammatory nature. He considered that any inflammatory changes which took place in a phthisical lung were secondary to tubercle, but that tubercle itself was quite independent of inflammation, and was, indeed, somewhat of the nature of a new growth, such as cancer. Again, that although certain other diseases, such as scurvy or syphilis, might hasten the development of tubercle, if such were present, they could not produce tubercle. Laennec's main work then was to demonstrate the unity of the various forms of the phthisical condition, since tubercle was the essential feature of them all. His view that tubercle was brought about by something quite apart from the normal or abnormal tissues of the attacked districts was, however, not accepted by his immediate followers.

The researches of Louis tended to confirm the conclusions of Laennec, and two points suggested by Laennec were formulated as definite and positive laws by this author, which for a number of years after the publication of his book in 1825 were accepted by the majority of medical authorities upon the subject. These two laws were the following :—(1) That tubercle invariably attacks the apex of the lungs first of all, and (2)

that tubercle is never found in the body after the age of 15 if it is not in the lungs.

Broussais, however, working at the same time as Louis, enunciated a different theory of the formation and origin of tubercle. He supposed that it was essentially a lymphatic structure produced by inflammation, whilst Andral, a few years later, was convinced that it was a non-organizable morbid secretion. These two views, it will be observed, were nothing in advance of the speculations of the preceding century, although they were brought forward with more appearance of pathological support.

To the mind of Cruveilhier tubercle presented itself as a peculiar variety of inflammatory product.

There can be no doubt but that from the point of view of treatment the researches and admirable work of Laennec and Louis had a most disastrous effect, since it was clearly their view that as tubercle was but a local manifestation of a diathesis, just in the same way as are the tumours of cancer, so there was little to be done in the direction of cure unless this was taken in hand by Nature herself.

In the next period of 20 years, that is to say, between 1830 and 1850, the influence of the improving microscopic knowledge began to make itself felt, but the study of microscopic pathology was much hampered by a want of knowledge of the normal histology of the tissues in general, and particularly that of the lung. Hughes Bennett and Lebert were the principal adherents of Laennec's doctrines at this period, and in their publications insisted very strongly and clearly upon the essential unity of all forms of phthisis and their dependence upon some influence outside the human organism. The accounts of Lebert's microscopic researches rather

tend to prove that he saw nothing in the tubercle but the new material, and did not recognize any of the normal tissues of the part mingled with it, such as granular nuclei or degenerating epithelium. It was about this period that Addison, whose influence among the English physicians of his day was great, utterly refused to accept the dictum that all phthisis is essentially tubercular. He believed and taught that a simple inflammation of the lungs might leave behind it patches of albuminous material, capable, on the one hand, of complete absorption, and, on the other, of disintegration and removal. The induration of the lungs produced in phthisis was not of necessity tubercular, nor were the scars and puckerings, so often found at the apices, to be regarded as positive evidences of former tubercular deposit. The inflammatory lesion was to him the important feature of the whole disease, and he looked upon the tubercle as an occasional complication. The gravity of any given case was in direct proportion to the evidences of inflammation which it presented.

These views were held in later times by Niemeyer, and have, in process of time, come to be regarded as having been originated by him. They were, however, formulated and expressed by Addison, and taught by him in London for many years before Niemeyer's work appeared.

Between the years 1845, when Addison's work was published, and 1865, the teachings of Laennec were more and more thrust into the background. The inflammatory nature of tubercle was, it was believed, clearly proved by the microscopic investigations of Reinhardt in 1850, which showed that every tubercular mass was composed of an assemblage of disintegrating epithelial and inflammatory products. Side by side with the inflammatory

theory a place was always found in the pathological discussions of this period for the lymphatic theory, which regarded all tubercular deposit as lymphatic overgrowth. The association of tubercular disease with enlargement of lymphatic glands was well understood, and the important fact was established by Buhl, that the development of a wide-spread tuberculosis was in some cases associated with the continued presence of one or more foci of caseous material stored up in lymphatic glands, thus proving the truth of the old idea held two centuries before that the lymphatic glands were sometimes the storehouses of a poison which might at any time be set free and give rise to a fresh attack of the disease.

A fresh stimulus was given to the investigation and study of the pathology of phthisis by the publication of the results of Virchow's labours in 1861. The views which he enunciated may be said to constitute the fourth great theory of phthisis. Their acceptance involved the rejection of the other three theories. Tubercle was not a growth of foreign origin, it was not a result of inflammatory degeneration, and it was not essentially lymphatic. It was defined as a cellular neoplasm, proceeding directly from connective tissue. Nucleated, as are the cells of all new growths, the elements composing the tubercular nodule might contain one or many nuclei of varying size, but the cells themselves were for the most part small. The tubercular growth was essentially a lowly organism, non-vascular, and very prone to degeneration. The caseous change was not thought to be peculiar to tubercle, but the yellow form of deposit was to be regarded as an aggregation of miliary tubercles. The pathological conditions around the growth were of inflammatory origin and not of necessity dependent upon the presence of the growth itself.

The next material advance in the study of phthisis was made by Cornil in 1867, who showed that caseous degeneration was always associated with tubercle, and that the so-called caseous pneumonia was not distinguishable pathologically from caseous tubercle.

In 1866, Villemin proved the truth of the idea, which may be traced through the writings of students of phthisis in all ages, viz. :—That tubercle might be conveyed from one individual to another by inoculation. Villemin's demonstrations at once turned the current of investigation in the direction of animal experimentation. At that period the disturbing elements which might be introduced into such experiments by want of absolute cleanliness and antisepsis were not recognized, and hence some of the results obtained were misleading. At first it was shown that any of the tissues of a tubercular subject were capable of setting up tuberculosis if injected into a susceptible animal. Further inoculations, however, appeared to show that tuberculosis might be set up by the inoculation of material not of tubercular nature, even the inoculation of inorganic matters (*e.g.*, of mercury). Results such as these, which were for many years implicitly accepted, shook the faith of those who believed in the specific nature of the tubercular poison, and also greatly strengthened the position of the holders of the theory of the inflammatory origin of tubercle.

A debate at the Pathological Society of London in the year 1872, in which many of the leading pathologists and physicians of this country took part, was opened by the late Dr. Wilson Fox, and gave occasion for a general review of the subject of tubercular disease of the lungs. It was firmly maintained by Fox that the process of caseation was essentially dependent upon "the starvation of the tissues" in which it took place. Caseation implied

obstruction or obliteration of the vessels of the parts around, produced in tubercular disease by a small-celled growth in the perivascular tissue. This small-celled growth was the essential feature of tubercular disease in all its forms. The old theory that it depended upon lymphatic hyperplasia was once more suggested, but not strongly insisted upon. It was further laid down by the late Dr. Moxon that chronic phthisis was a product of successive generations of tubercles. He believed that no tubercle lived three months. "Tubercle with its age forgotten," was his terse expression of this view of the causation of the chronic disease. The different clinical course which followed the development of a tubercular growth within the alveoli from that set up by a growth within the alveolar wall, was more clearly shown in this debate than had hitherto been the case, and many other points in the pathology of phthisis were made more prominent and established on a firmer basis than before.

The chief object kept in view by the experimental observers of the period between 1875 and 1880 was the great question of the specific nature of the disease. Cohnheim's dictum that "everything must be classed as tubercle which produces tuberculosis when inoculated into a susceptible animal." gave rise to a much wider extension of the practice of inoculation, and hence to a much closer study of the initial stages of tubercular formation and a firmer faith in the doctrine of the unity of phthisis.

The final stage in the appreciation of the nature of consumption was reached when it was shown by Prof. Koch that the disease is a specific one, and is invariably due to a specific micro-organism. As this discovery has materially altered our conception, both of the nature and course of the affection of the lungs of which we are

treating, we shall reserve an account of the steps which led up to this important result until the next chapter, in which, too, some of the chief pathological problems in connection with phthisis will be discussed from the standpoint of our present knowledge.

It should be noted that Koch's great discovery (which he announced to the Berlin Physiological Society[1] in the year 1882) had been rendered possible by the introduction of improved microscopic lenses and of powerful condensers for concentrating the light upon the microscopic object. For these improvements and for the perfecting of the microscopic apparatus generally the scientific world owes a deep debt of gratitude to Prof. Abbé.

[1] "Berliner Klinisch. Wochensch.," April 10, 1882.

CHAPTER III.

THE TUBERCULAR PROCESSES IN THE LUNGS IN RELATION TO THE METHODS OF ARREST AND CURE.

The Outcome of Koch's Researches upon Tubercle.—At the present time we are fortunately in a much better position to speak with authority upon the pathology of pulmonary consumption than we were even a few years ago, and are able to give a more consecutive account of the morbid processes which underlie the clinical phenomena of the disease, both when these processes are actively progressing and also when they are undergoing arrest. The researches of Prof. Koch have taught us to look upon phthisis or consumption of the lungs (at any rate in the vast majority of cases, *vide* p. 47), as part of a general and infective disease, *Tuberculosis*, and have shown us that tuberculosis, whether its local manifestation is in the lungs or elsewhere, is produced by the introduction into the tissues of a specific micro-organism, a bacillus —the *bacillus tuberculosis.* We have learned further that although pulmonary tuberculosis may be a part of a general infection of the whole body by the bacillus as shown by the presence of tubercles in other tissues and organs, yet as a rule, in the early stages at all events, it is the only manifestation of the affection, since the air passages are the most common channel by means of which the bacilli enter the body; tuberculosis being as a rule first of all localized to the neighbourhood of the primary inoculation, except in the rare cases of direct inoculation of the blood or lymph stream. In addition to this we

know that the rate of progress of the disease, the variation in its type, and the character of its symptoms depend to a great extent upon certain circumstances in connection with the introduction of the micro-organisms into the body and the spread of the infection.

Of these, the following are some of the most important: *First*, the condition of the patient's tissues, whether constituted by chemical composition or otherwise to lesser or greater resistance to the attack of the bacillus; *secondly*, the seat of the inoculation, some tissues resisting more than others the onslaught of the tubercle bacilli; *thirdly*, the number and very possibly the activity or virulence of the bacilli which effect an entrance into the tissue. It has been shown that in order to produce tubercular infection in an animal it is essential that the number of the bacilli introduced should be above a certain minimum, and this minimum not only varies for each individual, but also almost certainly varies in the same individual at different times, and, as we have implied above, according to the position or seat of the inoculation. The extension of the disease beyond the primary focus depends chiefly upon the greater or lesser freedom of communication between the initial lesion and the general lymph and blood streams, and also of course upon the greater or lesser power of resistance of the tissues at the seat of the primary focus.

Finally, we have learned from the further researches of Koch, and of others who have followed his lead in the investigation of the tubercular processes, that many of the symptoms of phthisis depend upon the action of the bacterial products, highly active and poisonous bodies now generally called "toxines," upon the tissues and organs of the body in general, and upon the central nervous system in particular.

These, then, are the chief data upon which we are now able to base our conception of the nature and progress of consumption; they have been arrived at only after most laborious and patient investigation. From them we have to derive our indications for the treatment of the affection.

We are aided, however, in this direction by the knowledge of the fact—long known and particularly insisted upon by Laennec, Louis, and their successors—that arrest and cure of the tubercular processes, even when they have become well established in the lung tissues, may certainly occur, and by a careful study of the conditions under which such arrest and cure take place. This knowledge has been derived from the observation of the lungs of patients who have died of diseases other than phthisis.[1] In a certain proportion of autopsies upon such patients, tubercular deposits in all conditions of cure have been observed.

In order to be in a position to appreciate the relation of the arrested disease to the progressive infection of the lungs, it will be necessary to discuss some of the most important points in its pathology a little

[1] *Records of arrested tubercular lesions* have been made within the last few years by several pathologists. Heitler "Ueber Heilbarkeit der Lungenschwindsucht" Wiener Klinik, 1880 (Pathological Institute, Vienna, 1869-1879), 16,562 autopsies; arrested tubercle observed in one or both lungs, 789, or 2 per cent. Ormerod (St. Bartholomew's Hospital, 1887-1890), autopsies, 1,020; arrested tubercular lesions observed in 50 cases, or about 5 per cent. T. Harris (Manchester Royal Infirmary), 38 per cent., but this percentage includes some cases of death from phthisis. Kingston Fowler (Middlesex Hospital), from 1879 to 1886, 1,943 autopsies; arrested tubercle found in 177 cases, or in 9 per cent. Sidney Martin (Middlesex Hospital), 1890-91, number of autopsies, 445; arrested tubercle in one or both lungs in 42, or 9·4 per cent. The proportion of arrested or so-called obsolete tubercle noted by others corresponds nearly to the percentages above given.

more in detail. Much light has been thrown upon this subject by the lucid description given by Koch of his investigations. Every step by which he reached his conclusions was amply supported. His primary thesis, that tubercle is a specific disease, and the greater part of the pathology of the disease as expounded by him, have received confirmation and support from the investigation of subsequent observers. Not only have we the work of Koch and his followers to help us, but recently we have received further assistance from the report of the Royal Commission on Tuberculosis which has been engaged since 1890 in the inquiry as to "the effect, if any, of food derived from tuberculous animals on human health; and, if prejudicial, what are the circumstances and conditions with regard to the tuberculosis in the animal which produce that effect upon man."

The main difference which distinguished Koch's work from that of some of his predecessors consisted in this, that he not only suspected, as did they, that tubercle is inoculable and capable when inoculated of reproducing the disease, but he was actually able to show in sputum and other excreta of phthisical people, and in all tubercular material a special bacillus which reacted to staining reagents before untried. This was Koch's first step in advance, his next was even more important and difficult. He succeeded in isolating the bacillus and in growing it outside the body. The last step in the completion of his work was the demonstration that the bacillus when grown outside the body was capable of reproducing tubercle when introduced into animals.[1]

[1] *Characters of the Bacillus Tuberculosis.*—The characters of the bacillus tuberculosis or, as it is usually called, "Koch's bacillus," may be briefly summarized as follows:—

The bacillus is a small rod, with ends more or less rounded, often

The Channels of Infection.—We have seen clearly, then, that phthisis is a disease originating in the infection of the body by a specific parasitic bacillus; we must now turn our attention for a short time to the question—

somewhat curved, about 1·5 to 3·5 micra (a micron equals one thousandth of a millimetre) long and about 0·2 micra in diameter. Non-motile. In stained preparations, unstained portions are generally seen, believed by some to be spores; often as many as three or four such spaces occur in a single rod, so that the bacilli may, under a low power of the microscope, be mistaken for chains of micrococci. The bacilli occur either singly or in twos or threes, but sometimes form a chain. When cultivated outside the body sometimes irregular forms are seen, the rods being swollen at places.

Staining Characters.—Tubercle bacilli are not easily stained with the anilin colours, but when they do stain they are equally tenacious in retaining the dye. Koch first used a solution of methylen blue and caustic potash, but this stain soon gave way to that which was introduced by Ehrlich, an anilin water solution of fuchsin or methyl violet; a 33 per cent. of nitric acid being used to decolorize the other bacteria and cell nuclei if present. The plan now used clinically to stain, with rapidity, tubercle bacilli in sputum and other excreta is by means of a carbolic acid solution of fuchsin (the exact formula of the stain being: Fuchsin, grm. i.; carbolic acid, grm. v.; absolute alcohol, 10 ccm.; distilled water to 100 ccm.), and the plan of staining is as follows:—The *sputum* which is coughed up in the morning is received into a wide-mouthed perfectly clean bottle, and is then poured to form a thin layer in a shallow glass dish. The dish, with its contents, is then placed upon a dark background, such as a piece of blackened glass. Generally speaking, in the sputum, which is not altogether purulent, small yellowish masses ("lentils") may be observed here and there, and one of these may be selected and may be taken up on a platinum needle; if necessary, may be cut out with scissors, as the material is very tenacious. One of these small masses is then placed upon a clean cover glass and covered by a second. The two cover glasses are then pressed together until a very thin film remains between them, the excess being squeezed out. They are then separated from one another by sliding apart and to each a thin film adheres. They are then allowed to dry, and afterwards are passed through the flame of a spirit lamp or Bunsen's burner to coagulate the albumen. When quite dry they are

where does this infection take place? Naturally, this question has received much experimental investigation. It is now generally agreed that the channels of infection are: (*a*) By the respiratory tract; (*b*) by the mucous

placed, film downwards, upon the surface of a watch glass full of fuchsin solution, which has been heated in a test tube, and are allowed to float upon this fluid for about five minutes. They are then taken with forceps (fitted with points not corrodible with acids, if possible), the excess of the stain is allowed to drain away, and the cover glasses are passed several times through water; after this they are passed rapidly through an acid solution (33 per cent. nitric or 25 per cent. sulphuric acid) until the red colour of the film almost disappears. This removes the fuchsin from everything else except the tubercle bacilli. The cover glass preparations are then thoroughly washed with water and allowed to dry. If the colour remains at all markedly in the preparations they should be passed through alcohol (50 per cent.) and again washed in water. The sputum is now ready for the second or counter stain, which is usually an aqueous solution of methylen blue. In this solution, which is best made somewhat dilute, the cover-glasses remain until the film appears of a light blue colour, after which they should be taken out, well washed in water, dried in the flame, and mounted in Canada balsam. The blue stains the bacteria other than the tubercle bacilli and the nuclei of the pus or mucous cells; so that the specific microbes appear bright red upon a blue background.

The microscope used to examine the specimens to ascertain whether tubercle bacilli are present or not, should be provided with an "Abbé's" or substage condenser, and if possible with an oil immersion lens ($\frac{1}{12}$th inch or upwards), but it is quite possible to see the bacilli when properly stained with a $\frac{1}{6}$th dry lens if by a good maker.

Biological Characters of the Bacilli.—The tubercle bacilli are essentially parasitic, and are incapable of growth outside the animal body unless artificially cultivated, and this accounts for the fact that the contagion of phthisis and of tubercular affections in general is not more intense than it is. The conditions of the growth of the bacilli as saprophytes outside the body are peculiar. They require a special kind of culture material. That which was first used by Koch was solidified blood serum. In addition to this, however, they will grow in nutrient Agar-Agar to which glycerin has been added to the extent of 5 to 8 per cent., and also in veal broth to which a similar

membrane of the throat, nose, pharynx, or alimentary canal; and (*c*) by wound or abrasion of the cutaneous surface. We will consider these seriatim.

(*a*.) First of all, *infection by means of the respiratory tract.* This must be considered of prime importance in

amount of glycerin has been added. Glucose may be substituted for glycerin. The bacilli are naturally aërobic, although probably capable of growing as anaërobes. The temperature required for growth is high, a few degrees above and below the mean temperature of the body being the only possible range (about 37° C.). The growth is slow, little indication of its commencement being apparent before ten or fourteen days.

Although tubercle bacilli do not as a rule multiply when outside the body unless artificially grown, they may do so in sputum which is kept moist and at a suitable temperature.

The facts which have been made out about the circumstances which affect the vitality of the bacilli are of the greatest importance from the point of view of the prevention of tuberculosis. The following are the principal:—They may retain their vitality in dried sputum for some months (8 to 10), but their virulence, *i.e.*, the effects produced when inoculated, is said to diminish. They also retain their vitality in decomposing material. Thus sputum, which has undergone decomposition, may, if the bacilli be present, continue to produce tuberculosis upon inoculation. They may pass through the stomach without injury. The most recent researches of the action of antiseptics upon the bacilli (Yersin) have shown that the bacilli (containing what he calls spores) are killed by five per cent. of carbolic acid in half-a-minute, by one per cent. in one minute; absolute alcohol in five minutes; iodoform ether, one per cent., in five minutes; ether, ten minutes; mercuric chloride (1 in 1,000), ten minutes; thymol, three hours; salicylic acid, 2·5 per cent., six hours.

One of the most pregnant facts bearing upon this question of vitality was first of all shown by Koch, and has since received ample confirmation, viz., that the bacilli are very susceptible to the action of direct sunlight; the bacilli in sputum being killed in periods varying from a few minutes to several hours, according to the thickness of the layer in which they are exposed to its influence. Diffuse daylight has a similar, but necessarily less powerful effect. Ransome and Délepine summarize this action in a few words: "Light is, in the case of the

relation to pulmonary tubercle, as it is generally through this channel that the lung becomes infected. The experimental proof that infection may take place in this way offered by Koch in his original paper may be accepted as being beyond question,[1] as it has received complete sup-

tubercle bacillus, as it has been proved by several observers to be in the case of other organisms, the *most important natural disinfecting agent.*" (*The Disinfection of Tubercle-infected Houses.*—" Brit. Medical Journal," Feb., 1895.)

Attenuation.—The pathogenic power of the tubercle bacilli may become to a certain extent attenuated if the cultures be kept at a temperature of 42° C. It is also stated that the far distant descendants of the early cultures of the bacilli originally isolated possess less pathogenic power than those taken earlier (*e.g.*, the ninetieth to the ninety-fifth culture from the original culture of Koch has been found to possess less virulence than earlier cultures, Löte). The attenuation is said to depend upon the lessened power to produce the toxine, to the action of which many of the ill-effects of the infection are due.

[1] *Koch's Experiment to show the Respiratory Tract as a Channel of Infection.*—Pure cultivations of tubercle bacilli or sputa from tubercular subjects were taken and rubbed up with water. The fluid was then diluted until quite clear and was allowed to stand until the fragments had subsided to the bottom of the containing vessel. Of this fluid, 50 ccm. were sprayed into a roomy box in which were placed eight rabbits, ten guinea pigs, four rats, and four mice, and the spraying was repeated on three successive occasions for half-an-hour at a time. After having been exposed to this moist air containing the bacilli, the animals were kept in separate and roomy cages. In the course of fourteen to twenty-five days, three rabbits and four guinea pigs had died, and the remainder were killed twenty-eight days after the inhalation. In every one of the animals experimented with, tubercles were found in the lungs, liver, and spleen. The appearances in the guinea pigs were very like those noticed in spontaneous tuberculosis. The control experiment with animals in each instance from the same litter as those experimented with proved that these continued healthy. The animals used for the experiment were healthy ones which had not been kept for any time indoors in the laboratory. The tubercles which resulted from these experiments were proved by microscopic examination to contain bacilli and also to be infective when used for inoculations.

port from the researches of subsequent observers. So, that which would seem to be highly probable from the position of the tubercular lesions, has been rendered certain. The experiments of Cornet—which proved that the dust taken from the walls, etc., of the rooms in which consumptives have lived for some time is capable of setting up tubercular disease when introduced into guinea pigs—have given us a clue to the way in which the inspired air may become infective.

It would seem almost certain that this danger arises from the fact that the sputum expectorated by consumptive people is not as a rule properly disinfected or destroyed. It is too often expectorated upon the floor, becomes dry there and so pulverizable, and thus forms part of the dust deposited upon the walls and floors of rooms. As dust, it is obviously capable of being breathed into the lungs. In like manner the sputum of such patients is often coughed into handkerchiefs or accidentally upon the bed or body clothes, and becomes dry and pulverizable in much the same way. We must look upon the sputum of phthisical patients as the chief danger and vehicle of infection. That it is not a greater danger is surprising considering the large percentage of the population affected with consumption (said to be 14 or 15 per cent.), the daily output from which of highly infective material must be immense. The three chief causes of this have been incidentally mentioned; they are probably these:—The gradual diminution of the vitality and the final death of the tubercle bacilli in sputum; their powerlessness to live and multiply, under ordinary circumstances, as saprophytes, *i.e.*, outside the body of a host; and, thirdly, the effect of direct sunlight upon their vitality. The question whether the air breathed out by consumptive patients is infective is not absolutely settled, but it is probable that if

infection by the breath ever takes place, such an occurrence is a very rare one. This question can hardly be discussed in this place.

It may be considered as practically proved that in tubercular phthisis the infection is usually by the channel of the air passages. It is, indeed, in the first place a local infection, and produces only local lesions.

The possibility of the propagation of tubercle by means of such of the domestic animals, *e.g.*, cats and dogs, as are sometimes affected by the disease, was carefully considered by Koch, but inasmuch as these animals have no sputum, this source of danger is not so great as it might be. The possibility of such an animal introducing some tubercular virus by "licking" the hand should not, however, be forgotten.

(*b*) When the channel of *infection is by means of the alimentary canal* the vehicle is naturally different, and takes the form of milk from, or the flesh of, tuberculous cows. The usual position of the infection in the alimentary mucous membrane is undoubtedly the small and large intestine, although, as we shall immediately mention, recent observations tend to show that the bacilli may be taken in higher up, viz., in the tonsils and pharynx.[1]

[1] *Experiments showing the Possibility of Infection through the Mucous Membrane of the Alimentary Canal.*—Animals, particularly rabbits, have been fed with phthisical sputum and other tubercular material, such as the internal organs, *e.g.*, the lungs, from other tubercular animals, and have after a time been found tuberculous. The tubercular deposits have, under these circumstances, been found chiefly in the mesenteric glands, which are first attacked, then the intestine, spleen, liver, and other parts of the body. The lungs are less commonly the seat of tubercle when the infection takes place in the alimentary canal. It is probably by a secondary auto-infection by the alimentary canal that phthisical patients who swallow their sputum

Finally, as regards (*b*), *the direct inoculation through the cutaneous surface*, this although rare has been shown by recorded cases as possible. For example, the warts which

become afflicted with tubercular ulceration of the intestines, which we shall see later on is a common complication of consumption.

Such feeding experiments have proved that the bacilli may pass through the stomach unscathed, at any rate in sufficient numbers to produce infection. That this is the case has been taken by some as proving that the bacilli contain spores; since sporeless bacilli, as a rule, are destroyed by the gastric juice. This evidence, however, is inconclusive, as when large amounts of bacilli are taken, it is highly probable that a proportion may escape destruction whilst in the stomach, simply from not having been exposed to the action of the juice.

As the vehicle of contagion which is much in use "*raw*" or *unboiled milk*, no doubt, is the most probable, and many experiments, made chiefly up to a short time ago on the Continent, have shown that milk is an undoubted source of tuberculosis. The careful investigations in Germany have shown, in Saxony, for example, in 1889, that of more than half a million of cows examined one per cent. suffered from tuberculosis, and in Berlin during the years 1887-1888 no less than 3·2 per cent. were similarly affected. Experiments with milk from tuberculous cows showed that a large percentage of samples contained tubercle bacilli, and when injected into guinea pigs reproduced the disease; in many cases, too. when derived from animals which had nothing apparently the matter with their udders. These experiments were chiefly carried out by Bollinger, Hirschberger, and Ernst, but they have been extended and confirmed by the researches of the Tuberculosis Commission, already mentioned.

As regards *meat* as a possible source of the contagion, the fact that it is almost invariably eaten after exposure to the considerable heat of cooking renders it a less dangerous article of diet, but even with meat it should be remembered that unless properly cooked we have a possible source of danger.

The entrance of the tubercle bacillus through the tonsils and pharynx has been considered with great care by Sims-Woodhead ("Lancet," Oct. 27th, 1894). The result of his observations upon this question may be shortly summarized thus:—

Tubercle of the lung is more often a secondary tuberculosis from

occur upon the hands of pathologists who are in the habit of performing autopsies upon tubercular subjects, the so-called "corpse-tubercles" have been shown by Karg and others to be due to the inoculation with tubercular material, and to consist of localized foci of tubercular nature. Some

infection of the alimentary canal than is usually supposed. Not only is it possible to show that such infection takes place in the intestine, chiefly in connection with the lymphoid nodules there, as shown by the tubercle of the mesenteric glands, but feeding experiments, especially in the case of pigs, have shown that the tonsils may be the seat of infection, and that they are themselves sometimes found tubercular or ulcerated, and that the glands in connection with them, the glands particularly near the cervical vertebræ, where they come in contact with the bone, are found to be enlarged and tuberculous. In some cases the chain of infected glands may be traced down the neck and so on into the thorax, by the mediastinal and post-sternal glands and by the intercostal lymphatics and glands, and "it is interesting in such cases to note how the lungs may be perfectly healthy until the glands in their root or in the pleura become distinctly affected." Woodhead believes that the bacilli may effect an entrance not only by means of injuries or abrasions of the mucous membrane with denudation of the epithelium, but also by means of the leucocytes (lymphocytes or "phagocytes") which are found in connection with the epithelium covering the various lymphoid structures of the alimentary canal. These wandering cells are capable of taking up the bacilli and of carrying them for certain distances, especially in connection with the stream of lymph. Under ordinary conditions these cells have the power to kill the bacilli, but in such cases when the number of attacking microbes is large, or the power of the cell is less than usual, the cell carries the bacilli perhaps only as far as the first gland, and then is overcome itself, with the result that the bacilli are set free and produce their ordinary effects. Woodhead is further inclined to think, and the results of post-mortem examinations appear to bear him out, that this method of infection by the tonsils and pharynx must be of comparatively frequent occurrence in the case of children living under insanitary conditions and subjected to various devitalizing influences; the vehicle for the introduction of the bacilli under such circumstances probably being unboiled milk.

of the cases of accidental infection by tubercular sputum have been told most graphically.[1]

Another, though one would imagine very rare, method of direct inoculation[2] of the body with the specific bacilli

[1] For the sake of illustration it will be interesting to reproduce one such case. It was narrated by Dr. Tscherning in the 'Fortschritte der Medicin,' Vol. iii., No. 3, 1885.

Maria P., æt. 24, cook in the house of the late Prof. H., strong and healthy; never affected with scrofula or tuberculosis. No hereditary taint of tubercle. Prof. H. died at the end of July, 1884, from acute phthisis, which had lasted five or six months. Towards the end of his life his sputum was almost a pure cultivation of tubercle bacilli. A few days before his death the patient wounded the palmar side of the first phalanx of her middle finger with a fragment of a broken vessel containing sputum. Commencing whitlow was observed a fortnight afterwards. Carbolic fomentations produced subsidence of symptoms without suppuration, but a small nodule the size of half a pea remained at the seat. The nodule remained painful, and this was removed at the end of August. The local symptoms improved, but in October the patient complained of pain in bending her finger. Later on a distinct swelling of the sheath of the flexor tendon could be made out, and still later there were two enlarged lymphatic glands at the elbow and two also in the axilla, but the patient was well in herself, and there were no signs of lung affection. On November 21st the swollen axillary and cubical glands were removed, and the finger was amputated at the metacarpal-phalangeal joint, and the palm was slit up and the tendon removed as far as possible. The subcutaneous granulation tissue was also removed. Under careful antiseptic dressing the wound quickly healed, and the patient did well. Tubercular tissue containing the specific bacilli were found in all the diseased tissues which were removed. This case showed the possibility of the introduction of tubercle bacilli by actual wound or puncture of the surface, and it also showed the gradual infection of the neighbouring structures, and later on of the lymphatic glands. In this case the operation, by removing the tubercular materials, in all probability prevented the general infection of the system with the bacilli, which in course of a longer or shorter time would almost certainly have taken place.

[2] A further possible method of direct infection, *i.e.*, by sexual intercourse, may also be mentioned.

has been demonstrated among the Jews in connection with the rite of circumcision. The custom is that the bleeding shall be stopped by the operator sucking the wound. If this sucking is done by a phthisical person, as has been reported, an infection of the child may take place.

The Pathological Processes set up by the Presence of Tubercle Bacilli in the Lung Tissue.—The result of the penetration of tubercle bacilli into the lung tissue is the production of small greyish-white almost transparent granules just visible to the naked eye, which are called "grey granulations" (Bayle) or "miliary tubercles." These miliary tubercles are seldom seen in the lung except in connection with a general pulmonary tuberculosis, but they may be studied elsewhere, especially well in the pia mater in cases of tubercular meningitis. It is by no means certain how these tubercle bacilli effect an entrance into the tissue beneath the epithelium of the air passages. Some would believe that they cannot do so unless there be an actual abrasion of the mucous surface; others would, however, suggest that the wandering cells or leucocytes may take them up and carry them into the tissue by virtue of their amœboid movements even in the absence of such abrasion. It would seem probable, at all events, that the first tubercle is usually situated very near the seat of the inoculation with the bacilli. Neither is it certain how many bacilli are required to effect an entrance before evidence is given of their multiplication and growth. We shall have to discuss elsewhere whether there is necessarily any difference between one individual and another in the constitutional susceptibility to tubercular contagion, but we may say in this place that Koch was strongly of opinion that the infection of the air passages is facilitated by an abnormal condition of the respiratory mucous membrane,

whereby either an abraded surface is left, or in which there is a secretion in the tubes of a viscid nature, difficult to dislodge, in which the tubercle bacilli might be taken up. In the latter case they might be prevented from undergoing the usual fate of the dust taken in in respiration, *i.e.*, that of being removed from the mucous surface by aid of the cilia of the epithelium to such a position that it is expelled by coughing. If entangled in such secretion it is nearly certain that the bacilli can multiply, and such a bacilli-teeming mucus would naturally be a source of great danger. In whatever way, however, the bacilli enter the lung-tissue, if in sufficient numbers, the result is the production of tubercles, but these are at first microscopic growths, so that in order to form a miliary tubercle visible to the naked eye we must suppose a congeries of such microscopic elements. A microscopic tubercle consists of such an aggregation of small cells, with large nuclei very similar to lymphoid corpuscles, certain larger so-called epitheloid cells, and finally, either in the middle or surrounding the mass, a variable number of large multinucleated, branched, myeloid cells, the so-called "giant cells." The branchings of the giant cells and the anastomosis one with another form a kind of fibroid meshwork in which the smaller cells may be contained. In the giant cells particularly, but also outside of them, are seen crowds of tubercle bacilli. Tubercles are, then, a result of the irritation of the tissue by the tubercle bacilli, and the irritation not only causes a collection of colourless blood cells, but also an increase in the number and size of the connective tissue corpuscles. When the tubercles are developed, as is usually the case in the inter-alveolar tissue of the lung, this becomes considerably thickened, and by pressure upon the capillaries in the walls

diminishes or even cuts off the blood supply. The effect of this, or, as is asserted by some, the local effect of the toxines of the bacilli, is to produce a retrograde metamorphosis in the tubercle; the cells in the centre undergo degeneration, the so-called *coagulation necrosis* of Weigert, and a mass of dull, non-nucleated material not easily stained with anilin dyes when cut into microscopic sections, results. This change alters the naked-eye appearance of the new growth. It is no longer greyish and semi-transparent, but becomes yellow, opaque, and "cheesy." This process, called for convenience "caseation," is believed to be characteristic of tubercle, but the tubercle bacilli may disappear from the cheesy mass, dying and undergoing disintegration. The yellow masses, rendered larger by coalescence of smaller ones, are, or have been, called "yellow tubercles."

There are, however, other changes in the pulmonary tissue produced indirectly by the irritation of the presence of the bacilli, of considerable importance from the point of view of the arrest of the process.

Methods of Arrest of Tubercular Processes.—It must be recollected that the formation of any considerable tubercular mass or nodule in the lung-tissue may not follow at once upon the entrance of the bacilli. It may be a very slow and chronic process. Its full development may take months, or even years, after the primary inoculation. At any rate, the time occupied may be considered to depend upon the number and vitality of the bacilli on the one hand, and the resistance of the tissue on the other. When the process is slow the number of cells produced is small, the amount of fibroid tissue produced is large, and the initial tubercular mass is exceedingly fibrous on section. It is thought that the bacilli may die in such a chronically-formed structure, or, at all events, may lose

much of their vitality. We may thus look upon this as the *first way in which tuberculosis may be arrested.* It is uncertain how long a chronically-formed fibrous nodule may remain in the lung as a standing menace of further tubercular affection. We have found tubercle bacilli in such quiescent masses, to all appearance indistinguishable from the virulent form. The mass, however, may remain quiescent as a hard fibrous nodule, or it may undergo *calcification*, and as such probably is even less likely to give rise to further trouble.[1]

As a rule, the irritation of the tubercles in the alveolar walls excites in the alveoli much inflammation, so that they become filled with epithelial cells much as they do in ordinary catarrhal pneumonia, or with fibrinous exudation and leucocytes, as in croupous pneumonia. This inflammation may be of great severity or may be only slight. If severe, considerable tracts of lung tissue become quickly consolidated, so that the pathological process extends far beyond the original seat of the tubercles. After a greater or lesser time, it is found that the alveolar walls may become obliterated, and the landmarks of the original tubercles lost. The cellular elements undergo caseation, and larger masses of a yellow colour and of cheesy nature result. These masses were formerly called caseous pneumonia, and their tubercular origin was overlooked. Under favourable conditions, however, this secondary implication of the alveoli may clear up, and the alveolar contents may be discharged before the

[1] *The question of the infective power of arrested tubercle* has been tested by Sidney Martin in a few cases. The result of his experiments, which were too few to be absolutely conclusive, appears to show that both caseous fibroid nodules and calcareo-caseous nodules, even though they may contain tubercle bacilli, are not of necessity infective when introduced by inoculation into animals. The chances are, however, that larger caseous masses are infective.

alveolar walls are destroyed. This explains the often observed fact that if a patient with extensive signs of phthisis rapidly developed, is placed under favourable conditions, great improvement in the physical signs may speedily occur; the pneumonia (either croupous or catarrhal) having cleared up. Under such conditions we must not forget that the initial cause of the inflammation —the tubercles—remains.

The most common result, however, of the caseation of the tubercle and of the inflammatory products, is that softening takes place and a so-called tubercular abscess results. Such an abscess after a time reaches the nearest bronchus and is discharged, leaving behind a distinct hiatus in the lung tissue, and a vomica, small or large, follows. Sometimes the same process affects several lobules of the lung. Whether the cavity undergoes reparation appears to depend upon several circumstances. First of all whether there has been set up by the irritation of the tubercular nodule an increase in the fibrous tissue of the lung in the neighbourhood, which will act as a more or less complete barrier to the encroachments of the bacilli which may be left in the cavity. If the tubercular process has been acute the fibrous tissue will be insufficient for the purpose, but if, on the other hand, it has been slow, the fibrous tissue may limit the disease, and the cavity may, under favourable circumstances, cicatrise. This, then, is a *second way in which the tubercular process may become arrested.* The second circumstance of importance is whether free expectoration is possible. In order that a favourable result may be obtained, the whole of the softened material must be quickly got rid of.

It should be noticed in passing that although the tubercles are as a rule situated in the neighbourhood of the alveoli in the first instance, or in the infundibular

passages to the air vesicles, yet they may first of all develop in the bronchial mucous membrane or in the peribronchial tissue. It is also of importance to remember that the presence of tubercles commonly sets up some catarrh of the neighbouring bronchi, and as they are almost always first formed in the apex of the lung, *persistent apical catarrh is of great significance*, and should suggest to the careful auscultator the possibility of tubercular deposits in the neighbourhood.

So far we have treated of tubercle of the lung as a primary and local affection, and as such it spreads, if it spreads at all, by continuity, a gradual encroachment of the diseased upon the healthy districts of the lung. As long as the spread is by this method only, there is always hope that arrest may take place—that a point may be reached where the resistance of the tissue becomes too strong for the further successful attack of the bacillus. This point may be arrived at sooner or later, according to the increase of the power of resistance impressed upon the patient himself and his pulmonary tissues in particular, by improved conditions. The battle against the invaders may be fought by the pulmonary tissues with a greater or less slaughter of its forces; but if the final result is victory it does not so much matter whether a tenth or a half a lobe has succumbed. It is by no means uncommon to find on post-mortem examination that the respiratory tissue of a whole lobe may be lost from extensive tubercular softening, leaving behind a cavity or a series of cavities with thick fibrous walls, or a puckered mass of fibrous tissue, or a series of fibro-calcareous scars, but that the remainder of the lung tissue is intact.

It will be readily understood, therefore, that in such a case, even although so large a proportion of the oxygenating tissue has been destroyed, a patient may be in a much

better condition than one in whose lungs the tubercles are widely distributed, even although the tubercles have nowhere passed through the several stages to complete softening and disintegration.

Such being the case, it is clear that the usual distinction employed clinically, of cases of phthisis into three stages, according to the three stages of the tubercular process, viz., first stage, that of consolidation; second stage, of softening; and third stage, that of cavity, is misleading, since no distinction is drawn between what is to all intents and purposes a local affection, even though it may have passed through the three stages, and the much more serious disease—a general pulmonary tuberculosis which has not anywhere passed through all these stages.

With reference to this point we can very heartily endorse the words of a recent writer upon the subject (Dr. Kingston Fowler). He says:—

"Few expressions have done more than this ('the stages of phthisis') to confuse the minds of students, and to prevent the unfortunate sufferers from the disease from acquiring such an understanding of their malady as their knowledge will allow. It is hardly necessary to insist that the so-called stages of consumption are stages in a pathological process, which may be arrested in any one of them, and that they have no necessary connection with the general advance of the disease. But it is difficult to make a patient who has been told that he has a cavity, which he knows to represent the third stage of the disease, believe that he is better off than many who are still in the first or second, whereas it is well-known that arrest in the stage of cavity may be complete and its duration indefinitely prolonged" ("Arrested Pulmonary Tuberculosis," p. 3).

Methods of Extension.—So far in our description we have supposed that the tubercular process proceeds only by continuity, by a gradual spread of the morbid action into the surrounding healthy tissue. There are, however, other ways in which the tuberculosis may become more extensive. It is thought by many that one of the most frequent of these ways is by means of *autoinfection of another part of the lungs* by the inhalation of the bacilli-containing pus from the primary tubercular focus which has undergone softening. It has been suggested as possible for the pus to be inhaled into another part of the same, or into the opposite, lung. If this infective inhalation takes place, it would be unreasonable to think that it takes place from any single sucking in of the purulent material into a healthy district; it is probable rather that it may be continually occurring. Fresh infective centres only arise supposing the laws which govern the original inoculation apply to the new foci. We are as much in the dark about these laws in the one case as in the other, but, as we have seen, it is thought that a previous interference with the healthy nutrition of the tissue is essential. Whatever the conditions for the secondary infection may be, it must be taken as a fact that such infections do occur, even if only occasionally, and this must be borne in mind in the treatment of the affection. All encouragement should be given to those affected with consumption in the early stage to breathe deeply and freely, and to fill, as far as possible, the whole of the lungs at each breath, so that the inspirations being forcible and complete may be followed by as deep and forcible expirations. By the latter the air passages are cleared, the separated secretion from the diseased region is ejected, and no encouragement is given to the reflux of the infective and purulent material into other parts of the

lungs. It would not be unreasonable to suppose that this prevention of secondary or autoinfection is one of the benefits which a patient derives from removal to a pure and more rarefied atmosphere, such as is found at the high altitudes. It is a well-known experience that the necessity for taking deeper inspirations than usual is felt when the atmospheric pressure is diminished. The *besoin de respirer* is, in fact, under such circumstances, markedly increased.

The spread of the tubercular process by means of the inhalation of the infective secretion of the primary focus, about which we have been speaking, is considered to explain the fact that the progress of the disease in the lung may be very slow and chronic, in spite of the lesions being multiple, which would not be so likely, supposing the secondary lesions were due to the implication of the lymph or blood streams. There is much cogency in this supposition, as the secondary lesions arising in such a manner exhibit all the possibilities of arrest which the primary focus possessed. All pathologists who have devoted special consideration to the lesions of phthisis have appeared to agree upon one point, if upon no other, viz., that the pulmonary lesions when multiple, in ordinary subacute or chronic phthisis, show evidence in the same lung of several successive eruptions of the disease, and Niemeyer considered these secondary eruptions, and no others, to be tubercles, properly so called; tubercles, in his opinion, being always secondary, and in this case to the primary focus of softened caseous pneumonia. The modern supposition, however, that the secondary lesions, when at some distance from the primary focus, are inhalation infections, allows us to look upon a case in which it is possible to make out these lesions with a much more favourable eye than if they

were due to infection by the implication of the lymphatics or blood-vessels.[1]

[1] *Dr. Fowler's "Line of March" of the Tubercular Disease of the Lung.*—Dr. Fowler has drawn up with much care an account of the usual sequence of the secondary tubercular deposits in chronic or subacute phthisis, according to his reading of the pathological records. His deductions have been drawn from a large number of autopsies, and are very suggestive to the practical physician. Endorsing the generally accepted fact that the apex of the lung is first of all attacked, he states that the first deposit is not at the extreme apex. It is situated most commonly from an inch to an inch and a half below the summit of the lung, and rather nearer to the posterior and external borders, and spreads backwards, this line of extension explaining the fact that the physical signs of tubercle are often first of all noticed over the supra-spinous fossa. In front, the lesion corresponds to the supra-clavicular fossa or to a spot just below the centre of the clavicle. The lesions then often spread down along the anterior aspect of the upper lobe, about three-quarters of an inch within its margin, and perhaps separated by an inch or more of healthy tissue. The second and less usual seat of the primary lesion is somewhat lower and more external, and corresponds to the first and second interspaces at the outer third of the clavicle. The lesion extends downwards. The part which next shows tubercular deposit is the apex of the lower lobe (the middle right lobe being passed over), from an inch to an inch and a half below the upper and posterior extremity, and about the same distance from the posterior border, a spot nearly corresponding to the chest wall opposite to the fifth dorsal spine, midway between the scapular border and the spinous processes. This lesion tends to spread backwards towards the posterior border of the lung, and laterally along the interlobar septum. The extension in the lower lobe is almost always from above downwards and by islands of deposit of racemose shape, with healthy lung in between. The second lung is seldom the seat of secondary deposits until the lower lobe of the lung first attacked is implicated. The lesions are usually situated in the same situations to those of the apex of opposite side, but sometimes their site is close to the interlobar septum, midway between its upper and lower extremities, corresponding to the upper axillary fold. Extension in the lower lobe of the second lung follows the course of the lesions in the lower lobe of the first lung.

It has been recently pointed out by Prof. Baümler, of Freiburg, that the inhalation of the purulent material from one part of the lung into another may set up there a severe form of pneumonia, not of necessity due to tubercle bacilli or accompanied by the formation of tubercles. It may be that this pneumonia is the precursor of secondary tubercular deposits by producing the primary disorganization of the lung tissue, which, according to some, of necessity precedes the deposit of tubercle.

The next method by which the spread of the tubercular process in the lung is effected is by means of *the implication of the blood-vessels, both veins and arteries.* The tubercle bacilli may attack the coats of, and finally penetrate through the walls of the blood-vessels, both large and small. It appears probable, however, that they may produce destruction of the vascular wall without entering the blood stream themselves. Hæmorrhages due to vascular lesions of this kind are not uncommon. If the bacilli enter the blood stream, unless they perish by the protective action of the plasma or of the blood-corpuscles, which is possible, they are carried to distant parts of the same lung, to the opposite lung or to other parts of the body, and there form tubercular foci—the number and distribution of which vary according to the size and nature of the vessel they enter. The next way in which the secondary lesions may occur is by *implication of the lymphatic vessels.* The intimate relation which exists between the pulmonary alveoli and the lymphatic system makes it somewhat remarkable that the implication of the general lymph stream does not take place early in pulmonary tuberculosis. This is almost certainly due to the fact that the bacilli are arrested in the corresponding lymphatic glands. It may be that they are destroyed there, as considering the numbers which must pass

to them, few bacilli can be demonstrated in that situation by microscopic examination. There is abundant evidence that the glands in connection with the lungs are the subject of frequent enlargement, softening or even calcareous changes. The laws that govern the blocking of the bacilli in these glands are little understood, and we are unable to say why general involvement of the lymphatics takes place, as it is said to do by competent observers, in some cases, and not in the majority of instances.

When the general blood and lymph streams become infected with tubercle bacilli the result is a general tuberculosis in which the whole of the so far intact pulmonary tissue is involved. In fact, under such circumstances we have to do with a condition of affairs which is produced experimentally in animals by the direct injection into their vascular systems of considerable quantities of active bacilli. Much the same result arises in advanced cases of infection of the system through the alimentary canal, and also if the entrance of the specific micro-organisms by wound or abrasion of the skin is of considerable extent, and their further progress is not stopped in the neighbouring lymphatic glands. It will be necessary briefly to allude to the general tubercular infection of the body. This may be acute or chronic, producing what is called respectively acute or chronic miliary tuberculosis. Unfortunately, from the point of view of this book, these affections might be passed over in silence, as no case of recovery from general tuberculosis has, so far as we know, ever taken place, and all forms of treatment hitherto suggested have proved unavailing.

Acute and Chronic Miliary Tuberculosis.—As mentioned above, general pulmonary tuberculosis may be part of a general tuberculosis, either acute or chronic.

General miliary tuberculosis appears to occur under the following circumstances:—Koch was strongly of opinion that the extension of tubercle from a primary focus is to be attributed to the leucocytes. These wandering cells take up the bacilli and carry them for short distances by means of their inherent power of locomotion, but as this power is comparatively small, in a short time the cell is stopped in its course and forms a centre for the formation of a tubercle at a short distance from the primary focus. If, however, these cells carrying bacilli in their protoplasm pass into the lymph stream, the distribution of the bacilli is wider and tubercles are likely to arise in the course of the lymphatics. Failing a stoppage on their way, the bacilli are carried to the next lymphatic gland, where they excite enlargement, tubercle and caseation, but, as a rule, the bacilli go no farther; they are, as we have mentioned above, detained and probably disorganized in the glands. This is the general rule, but sometimes it appears that the glands are unable to stop the entrance of the bacilli into the general lymph stream, and the consequence is that they reach the blood through the thoracic duct. If the number of the bacilli entering at a time is considerable, acute miliary tuberculosis is set up, and after a short course the patient dies, and on autopsy the lungs, liver, and spleen, and probably other organs besides, are found full of tubercles of the miliary variety, grey or pale, or yellow, according to the length of the clinical course. This was noticed in a remarkable case recorded by Ponfick, of tuberculosis attacking and penetrating the thoracic duct itself, and also in several equally remarkable cases, mentioned by Koch, of tubercles growing into and penetrating the walls of veins or even arteries (Weigert). When the tubercle bacilli which enter the blood stream, or, at any rate, survive to set up tubercle,

are few in number, the result is, that the tubercles which are produced are less numerous, less widely distributed, and more chronic in their growth (chronic miliary tuberculosis).

It has been necessary to mention the relationship between any tubercular focus and general miliary tuberculosis for the sake of impressing the fact that any tubercular deposit containing tubercle bacilli, such as a tubercular gland, an apparently healed deposit in the lung, a tubercular joint, or what not, always remains as a possible source of danger to the patient in whom they may be detected.

The Question of the Cause of Arrest of Tubercular Processes in the Lung.—That the tubercular process can be arrested in almost any stage there is abundant post-mortem evidence. The actual pathological processes by which arrest may take place are also well known. When, however, we come to the question as to why at a certain time the activity of the tubercular process should cease, we are much more at a loss. All we can say is that the resistive power of the tissues has increased, and that the activity of the bacilli is either suspended or cut short. We shall have to return to the subject again when we consider the whole question of susceptibility.

One remarkable fact we may mention in passing, and that is, that certain diseases appear to be antagonistic to the continued life of the tubercle in the tissues. Some very specific statements upon this subject have been made by competent observers, and were the subject of much correspondence in the medical papers some years ago. Cases were described which appeared to undergo cure, although in several the tubercular processes had proceeded far, after attacks of such acute fevers as small-pox, rheumatic fever, and erysipelas. It has also been stated that similar

effects follow attacks of acute gout. We have ourselves seen an apparently complete arrest or cure of pulmonary tuberculosis, considerably advanced, in the case of a patient who suffered severely from an intercurrent attack of gout. Whether these are mere coincidences, or whether they point to some antagonistic action between the poisons of these diseases or not, it is of course impossible to decide.[1]

Of Phthisis of Non-tubercular Origin.—In the preceding account of the pathological processes in phthisis, we have assumed that all such processes have their origin in tubercular infection. Our account of the disease would, however, hardly be considered complete without an

[1] *Cases Illustrating the Apparent Antagonism of Certain Acute Affections to the Tubercular Processes.*—Dr. A. W. Lawrence, of Chepstow, in a letter communicated to the "British Medical Journal" (January 24th, 1891) by Sir Wm. Broadbent, relates the cases of two young men who were "in the last stage of pulmonary consumption, with large vomicæ and great emaciation. They were attacked with small-pox of a virulent type, with very high temperatures. In each case they were well nursed and supported, and fed hourly with liquid nourishment and brandy, and both recovered from the small-pox, and *at once the pulmonary symptoms* disappeared. The patients laid on flesh, and are now the living images of health." Dr. Eddowes ("Brit. Med. Journ.," February 7th, 1891) related a case of a servant girl, æt. 16, with cough for a year, loss of flesh, and dulness over the apex of the left lung, with mucous râles, who had rheumatic fever lasting for several weeks. After the rheumatic fever the physical signs in the lungs and the symptoms of phthisis disappeared. Dr. Thomas Cole, of Bath, in the same number of the Journal, relates the case of a young gentleman, whose symptoms pointing to rapidly advancing phthisis, considerably improved after an attack of acute rheumatism. Dr. W. H. McNamara also related how, in the case of a soldier, extensive tuberculous ulceration in the glands of the neck, with suppuration of most obstinate and chronic nature, disappeared after an attack of erysipelas. He mentions that several similar cases had been related to him by other surgeons.

acknowledgment of the possibility of the occasional production of a chronic lung affection, in many respects similar to tubercular phthisis, from other causes than the introduction of the specific bacillus. A considerable amount of evidence has been brought forward to support the contention that a variety of phthisis may be from its commencement to its termination a pure fibrosis, never complicated with deposit of tubercle. A careful account of this somewhat rare disease has been within the last year or two drawn up by our late colleague, Sir Andrew Clark, with the assistance of our colleagues, Drs. Hadley and Chaplin ("Fibroid Diseases of the Lung"), to which reference for all details concerning the question should be made. In this work the authors have collected many cases, some of which they consider are instances of pure fibroid disease of the lung, to which the term "fibroid phthisis" should be restricted; other cases are those in which the primary lesion was tubercular, but in which there has been an after-development of an excess of fibroid tissue; these they call examples of "tuberculo-fibroid" disease. We have already dealt with such cases in the text. The third class of cases of fibroid disease they have named "fibro-tubercular" disease, in which the primary lesion has been fibroid and the secondary development of tubercular character. The development of fibroid disease in the lungs with or without tubercle is specially connected with the following etiological conditions:—Pneumonia, either croupous or catarrhal; chronic bronchitis; pleurisy; collapse of the lung; inhalation of dust and irritating particles, metallic or mineral—in such circumstances often called "coniosus pulmonum"—alcoholism and syphilis. As regards the last-mentioned cause, viz., syphilis, it may be said that although such a disease may have the power of diminishing the resistance

of the individual to the tubercle bacillus, and so may be considered a cause of phthisis, pure syphilitic disease of the lung is rare. It is also difficult to distinguish from any other disease of that organ in which there is abundant development of fibroid tissue. It is said that in this disease the fibroid affection commences in the walls of the interlobular blood-vessels, and only subsequently attacks the peribronchial and interalveolar structures. In very rare cases, however, gummata have been seen.

CHAPTER IV.

THE CAUSATION OF PHTHISIS IN RELATION TO PROPHYLACTIC TREATMENT.

The Question of Susceptibility to Tubercular Infection.—Although the discovery of the bacillus of tubercle has considerably simplified the problem of the causation of phthisis, it has not completely solved it. There yet remain certain questions in connection with the subject which must be answered before we may hope to be able to effectively combat and ultimately to prevent the spread of the disease. These questions principally have to do with what is commonly known as the predisposition to tubercle, or the susceptibility to the disease, which obviously varies greatly in intensity in different individuals and under different circumstances. Of the exact nature of this susceptibility we can only at the present time offer conjectures; but the careful observations which have been made of the conditions under which phthisis is specially apt to occur supply us with data of considerable importance in our study of the subject.

Conditions conducing to Production of Susceptibility.—We learn that the conditions which conduce towards setting up the susceptibility to tubercular disease belong at least to two classes, viz., *first, those connected with the individual*, and *secondly, those connected with the environment.*

To the first class belong the following: age, sex, race, general conformation of body, hereditary taint, and the

condition of the organs of the body, whether previously healthy or the seat of antecedent disease.

And to the second class belong the circumstances, the individual surroundings, the climate and locality of dwelling place, occupation, and the like.

Each of these important factors in the etiology of phthisis must be briefly considered in turn.

(1.) CONDITIONS CONNECTED WITH THE INDIVIDUAL.—*Age and Sex.*—It cannot be said that any particular age is immune to tubercular disease of the lungs; even as to the age at which tubercle is most liable to be set up, statistics are by no means conclusive. We may, however, take those of Würzburg, who, in a communication on the influence of age and sex on the mortality from phthisis ("Mitt. aus der K. Gesundheitsamt.," 1884), gives tables which show that for every 10,000 deaths in Prussian States during the years from 1875 to 1879 the number of deaths from phthisis steadily increased from 20 to 25 up to the maximum in the periods from 60 to 70, falling again after that, the figures for the very aged and the very young nearly approaching one another. Below 20 the numbers vary a little for various periods, those below the age of five being more fatal than those above, with the exception of the 15 to 20 period.

Statistics derived from death tables must, however, produce somewhat different results from those compiled from clinical sources. Taking a series of cases, without special selection, from the records of the Victoria Park Chest Hospital, the period of life in which the larger number of cases occur is undoubtedly that between 25 and 45 years of age. A difference is, however, to be noted between the male and the female sexes respectively. The females appear to be attacked earlier, and hence the largest number of cases of the female sex appears between the

ages of 25 and 35 years. The actual figures are as follows. The numbers investigated were 808 males and 244 females.

					Age of Onset.			
Ages.	Male.	%	Female.	%	M.	%	F.	%
0-15	18	2·2	22	9	9	5·5	12	12
15-25	202	25	68	27·8	52	31·7	47	47
25-35	280	34	78	32	67	40·8	26	26
35-45	218	27	55	22·5	36	21·9	15	15
45-65	90	11	21	8				
	808	99·2	244	99·3	164	99·9	100	100

The percentages are given approximately only. The table of Age of Onset, placed here for comparison, was compiled from a different series of cases and limited to 164 males and 100 females, and shows very clearly the greater liability to earlier attack on the part of the females.

This increased liability is not, however, a very important factor except in so far as it may indicate that the close confinement in the stuffy atmosphere of crowded school-rooms and overcrowded dwellings reacts more upon the girls than the boys, in whom these conditions are counter-balanced by the greater length of time spent in the open air. The relatively fewer number of women attacked by tubercular disease later in life may be accounted for by the natural operation of the earlier attack. Those in

whom the disease develops soonest succumb to its effects earlier in life. Of the conditions which seem to predispose to the development of tubercle in later years are the effects of prolonged lactation, which is often associated with poverty and insufficient nourishment, and sometimes, the cessation of the child-bearing period in those who have been prolific and yet free from disease in their earlier years.

On comparing statistics derived from town dwellers with others compiled from country dwellers, the greater mortality of the town life is made very manifest, but as a natural consequence, the deaths are more numerous amongst country dwellers than townsfolk between the ages of 45 and 60. In other words the town-dwelling consumptives do not live to reach these ages in anything like the same proportion as the country folk. In the country, again, the death rate amongst the males increases with advancing years, in comparison with that amongst females, owing no doubt to the greater powers of survival of the males who have lived for the most part an open-air life. Death rate from phthisis, whether actual or relative, varies so much in localities, that too much stress must not be laid on statistics, and the only general conclusion that may safely be drawn is this, that the disease is apt to attack females at a somewhat earlier age than males, and as a consequence, it comes in them to an earlier termination. This general conclusion is not without its importance in considering prophylactic treatment for boys and girls respectively.

Race.—Differences may be traced in the distribution of phthisis throughout the different races of the world, but these differences are neither sufficiently striking nor sufficiently uniform to enable one to state definitely upon what conditions they depend. The disease is, as a broad

rule, more fatal to coloured races than to Europeans, and especially in the case of the American and African negro. In the Southern Pacific it is prevalent and fatal in its results to the natives, but to what extent this prevalence and fatality are due to the adoption of Western habits and mode of life, or to some inherent susceptibility on the part of the native, there is no positive evidence to show. In tropical regions, just as in the temperate climates, the disease is apt to occur in some localities and to be almost unknown to others, which geographically and ethnographically speaking are identical. This is especially to be noted in Central America. The type of disease met with in Ceylon, the East Indies, and in Cochin China is described by Hirsch as "extremely pernicious," and this may in part be due to the somewhat feeble vitality and ill-nourished physique of the majority of the poorer natives of those countries. Prevalence has almost always been computed from the death-rate, and it is possible that the higher death-rate in some of the countries does not truly express the actual prevalence of the disease as compared with temperate regions, where consumptive people frequently die of other diseases and are registered accordingly.

General Physique.—From the earliest times certain types of face and form have been associated with a tendency to tubercular disease of the lung. When closely analyzed, however, these types are so often to be met with in association with other diseases, or even with no disease at all, that their value is thereby considerably lessened in estimating the probable powers of resistance of any individual to an attack of tubercle. The types laid down by Sir William Jenner for tubercular and strumous subjects respectively may be met with in very many cases of phthisis, but are wanting in many others,

while the delicate type of form, called by him "tubercular," is not uncommonly met with in healthy persons. Thus a "consumptive-looking" person is by no means always consumptive, and if no hereditary or other indications of a tendency to tubercular disease be present, the outward form alone need not be taken as an indication for special precautions. The occurrence of chronic cough, loss of flesh, or an attack of pleurisy in a "consumptive-looking" person, must, on the other hand, be regarded as possibly of tubercular origin, and should be treated accordingly. In like manner the "consumptive" aspect in any member of a family in which a tubercular history may be traced should be taken as an indication for special prophylactic care. More especially is this the case when a single member of such a family betrays the characteristic features. The absence of any appearance of delicacy in brothers and sisters often leads the parents to disregard the indications of tubercular susceptibility in the one child and to permit risks to be run and precautions to be neglected which may bring disastrous consequences in after years.

Apart from general facial expression or form, the shape of the chest has often been thought to exercise some predisposing influence to the development of the disease. Here again it is essential to remember, in judging of any individual case, that persons with malformed or even the typical flat chests are by no means always consumptive. Hence the flat chest must not be taken alone as a sufficient sign of the "consumptive tendency." A very large proportion of all consumptive cases present a form of chest which differs from the thoroughly normal type, but at the same time cases are not infrequent where the form and movement of the chest appear normal, although advanced disease may be present in one or both lungs. The

shape of the chest as seen in later years when disease has developed is usually the result of antecedent lung or pleural disease, or is the outcome of prolonged habits of stooping, or other unhealthy attitude. A severe or prolonged attack of whooping-cough during the early years of life may produce secondary results in the form of emphysema, collapse, or possibly fibrosis, which may imperceptibly lead to a gradual but decided narrowing or falling-in of parts of the chest wall. In the same way the common attitude of the clerk bending over his desk, or the shoemaker over his last, leads by slow degrees to a diminution of expansion and subsequent atelectasis of lung, which is followed in its turn by alteration in the shape of the whole chest. Organs which are insufficiently used are certain in course of time to become badly nourished, and to suffer accordingly, and the lungs form no exception to this rule.

Hence the importance of correcting slovenly habits of attitude in children, but especially in those who may be suspected of a tubercular proclivity. Many children habitually lie in bed in positions which prevent the proper expansion of their lungs, and this habit may be continued, if not watched and corrected, until some permanent defect is produced in the conformation of the chest walls or the spine.

Heredity.—We next come to the important question of heredity. It is impossible to ignore the fact that in a certain proportion of cases of pulmonary tuberculosis, a distinct family history of the disease may be made out. In a long series of cases at the Chest Hospital we found that 33·9 per cent. of the male cases showed a "family history," and 64 per cent. of the female cases. This apparently large difference must be accounted for by the relatively larger number of males who were ignorant of the antecedents of their immediate relatives. In both

sexes direct heredity from parents seemed to be less marked than the occurrence of the disease in some members of the patient's own family, brothers or sisters. The male cases showed inheritance from father or mother about equally, but the female cases rather more from the mother than the father. In some cases the family predisposition is very striking. We occasionally meet, for example, with a family in which the father has died of consumption, and the sons develop consumption one by one at about the same age, although living under different conditions in different parts of the world, and die after a greater or lesser period of suffering. The objection which has been raised to the theory of family predisposition on the ground that tubercular lung disease causes so large a proportion of deaths among the population "that without hereditary taint there would be nothing surprising in the fact that half the consumptive patients have had consumptive relatives unless the families were unusually large, and if we draw grand-parents and collateral relations into the statistical net, it breaks at once and holds no solid conclusion,"[1] when we discover that direct transmission from parent to child can be made out in upwards of 30 per cent. (our own statistics give a larger percentage). It is very unlikely, however, in hereditary cases that any actual infection of the fœtus in utero ever takes place. We fully believe that in such cases it is only a special susceptibility of the tissues or want of resistive power which is transmitted.

Next, as regards *individual susceptibility.* It has been shown to what extent such susceptibility may be looked for in the conditions of life to which the patient was born, and it now remains to consider what part is played by

[1] Ransome, "The Causes and Prevention of Phthisis," Milroy Lectures, 1890, p. 76.

the diseases, constitutional and accidental, to which he may be subject. Taking first the so-called diathetic conditions of gout and rheumatism, there is no striking association between them and the incidence of tubercular disease. Of 140 male patients only 18 had presented any manifestations which could be classified as "gouty," and only 15 gave any history of any rheumatic affection. Twelve had always been "delicate," but could give no positive account of illness, whilst no less than 92 out of the 140 declared themselves as having been free from any constitutional illness until the onset of the tubercular disease. The effects of syphilis are but rarely to be classed as leading to the development of tubercle of the lungs, although there can be no doubt that syphilis sometimes plays an important part in the course of the very chronic and fibroid forms of phthisis to which we have referred elsewhere. Other forms of chronic poisoning, as by lead, arsenic, or other chemical which may be met with in the course of certain manufactures, must also be held to predispose to the development of tubercle, and in like manner the more acute effects produced by febrile diseases, measles, scarlet fever, typhoid, etc., in which the patient's strength is rapidly reduced, are often followed by an attack of tubercular disease. The truth of this latter observation has been strikingly illustrated during the last few years since the mysterious febrile disease known as "influenza" has been prevalent. Instances have been numberless in which the beginning of tubercular disease has directly followed an attack of influenza. But in all these conditions, whether diathetic or the result of acute or chronic chemical or pathological poisoning, the whole chain of symptoms points to the lighting up of previously existent tubercle, rather than to any direct infection from without. In other words, tubercle

stored up in the individual may find a suitable soil for its development when the tissues have been materially altered or reduced by the processes referred to. Pathological evidence proves that tubercle may remain so stored up till the end of life without alteration, and in the vast majority of cases in which tubercle has been rendered active, a focus of old and hitherto quiescent tubercle may be found, if carefully looked for, stored up in glandular or other tissues.

To the affections which may thus be classed as exercising a debilitating effect upon the body generally, we may add the effects of prolonged lactation, frequent pregnancies, mental worry, and alcoholism.

Influence of Disease.—Diseases affecting the lungs and pleuræ appear to exert a decided local influence in determining the power of resistance of those organs to the development of the bacillus, but they do so in unequal degree. Acute bronchitis is by no means so powerful a factor as might be supposed. Chronic bronchitis in like manner often runs its course for years in an apparently tubercular subject, without any symptoms to indicate the presence of the specific disease. In a considerable proportion of cases, however, chronic cough extending over many years is a forerunner of phthisis. In 200 cases of male patients engaged in indoor occupations there was a history of chronic cough in 87 cases, giving a proportion of 43·5 per cent., while in 132 cases of patients following outdoor employments, 65 had suffered from chronic cough, giving a very similar percentage, viz. 49·2 per cent. The presence of emphysema, or other chronic structural changes in the lung tissue, would seem to have a deterrent effect upon the spread of tubercle. Pleurisy is a fairly common antecedent, and the question has often been raised whether such pleurisy is not of itself tuber-

cular in the first instance. In the large proportion of pleuritic cases a previous or subsequent association with tuberculosis is probable, and therefore the occurrence of pleurisy in the history of a tubercular patient must be held to render such a patient more susceptible than another to the development of tubercle in the lung.

The influence of pneumonia is not so clearly to be traced. A consumptive person may suffer from pneumonia and may recover from it as completely as a non-consumptive person, but cases are of fairly frequent occurrence where an attack of pneumonia is followed by symptomatic recovery and where the patient seems to do well for a time, but a cough remains with occasional slight feverishness, and this on examination is found to be associated with the presence of morbid changes in the parts of lung affected previously by the pneumonia, which have never cleared up and in some instances ultimately become disintegrated and are gradually coughed away, leaving a cavity behind. Bacilli may or may not be discovered in the *débris* ejected with the sputa, but in any case the presumption is strong that the part of the lung thus disintegrated has become the seat of tubercular disease.

The association of diabetes with tubercular disease of the lung is not by any means common, although it was formerly thought to be so. That many diabetics die of phthisis at last is unquestionably true, and especially between the ages of 20 and 35, but amongst a very large number of consumptive patients during that period of life, diabetes is very rarely met with. Lung diseases of all kinds may occur in the course of diabetes, and are thereby rendered more serious or more fatal, and are peculiarly prone to lead to gangrene of the affected tissue. Tubercular disease of the lung must therefore be regarded

as a complication of diabetes, although tubercular persons are not especially prone to suffer from diabetes.

(2) Conditions Affecting the Environment.—Let us next turn to the influence of the patient's environment upon the susceptibility, and first of all to the question of *climate*.

It was formerly supposed that phthisis pulmonalis was the disease *par excellence* of damp and changeable climates, but that this is not the case has been shown by more extended statistical information.

Although considerable differences are to be traced between one region or district and another, still there are in such cases other circumstances which have more weight in determining these differences than the geographical position or climatic conditions of the places themselves. It is not only between one country and another, or even between one province and another, that these variations are noticeable, but even between one parish and another in the same county! The returns from the various parts of England and Germany, exclusive of the large towns, show this variation in the most marked degree. Dr. Arthur Ransome, in his Milroy Lectures[1] in 1890, illustrated this very clearly by contrasting the highest and lowest death-rate from phthisis in individual towns of single counties in England, showing that in some cases the difference between the highest and lowest death-rate was often as great as 3 to 1, even in the cases of small towns not far removed from one another geographically. The returns published by the "Kaiserliche Gesundheitsamt," in Berlin, illustrate the same thing in the most elaborate manner. The prevalence of the disease does not always follow the density of population. Comparison of the relative death-rates in some places shows a preponderance on the side of the sparsely

[1] *Loc. cit.*

populated districts, and this may in a measure be due to the very sparseness itself, which always conduces to intermarriage between related families.

Remarkable instances of this may be traced in some of the Welsh and Scottish glens, where the death-rate from tubercular disease is often abnormally high from these causes.

As regards the influence of the *seasons*, some variation may be noted from year to year, but the variation is not great. Thus on examination of the Registrar-General's returns for the year 1889, the death-rate from phthisis per 10,000 inhabitants only fluctuated between 140 and 180, while in the following year (when influenza was very prevalent) the mortality ranged from 260 in the month of January to 140 in the month of July, rising again to 180 in the following December. Comparing these figures with those of death from diseases of the respiratory organs generally, a very marked difference is seen. Of these, the figures ranged between 520 in January and 150 in July in 1889; and in 1890 the difference was still greater, being no less than 920 in January and 200 in August and September. Thus while the mortality from other diseases of the respiratory organs varies directly with the season of the year, phthisis varies but little in some years and not at all in others.

We are thus driven to the conclusion that phthisis is a disease of all parts of the inhabited globe at all seasons of the year, even of the extremely hot and extremely cold regions, that its distribution is very unequal, and that this inequality prevails in small as well as large areas where no perceptible geographical variations can be traced.

The condition of the *soil*, and especially of the *sub-soil* of any district where phthisis is prevalent, has been held by many observers, following the oft-quoted records of

Drs. Buchanan and Bowditch, to have a marked influence upon the spread of the disease. The improvement that has followed the better drainage of damp areas, or of districts where the sub-soil was impervious to moisture, has been sometimes regarded as conclusive evidence of the direct relation of the condition of soil to the occurrence, or, more properly speaking, to the mortality of phthisis, since statistics have for the most part been compiled from death-rates. Further observations have been made by competent observers, and many facts brought to prove that in many districts, with all the conditions of surface moisture, impervious sub-soil, and insufficient drainage, neither the prevalence, nor the spread, nor the mortality of phthisis is above the average. The influence of soil, therefore, must only be regarded as one amongst many of the factors that combine to render the body more susceptible to the development of tubercular growth within it.

Tubercular disease exists, as has already been stated, in places where all possible conditions as regards dampness are present, and it is an undoubted clinical fact that the disease is sometimes arrested by removal of the patient from a dry area to a damp one, or the reverse, and that the mere change of atmospheric surroundings is often found effective, even though the change be from a presumably healthy climate to one less favourable.

Next to the influence of climate, locality, and soil upon the susceptibility to tubercle, we must consider the question of *occupation.*

Its exact influence is not known. It is, however, a fact that more persons die of phthisis engaged in certain occupations than when engaged in others. For example, it has long been known that workers in certain trades are subject to a special form of lung disease, producing a

condition of the tissue in which there is an increase in the fibrous elements leading to contraction, and, after a time, to actual loss of substance. This condition is usually called *Coniosus Pulmonum.* It is a very rare disease. It attacks workmen whose occupations expose them to the inhalation of dust, particularly coal dust, steel filings, dust from grind-stones, glass and the like, and even, it is said, to dust from cotton goods and similar materials. It is a matter of dispute whether, in such cases, the lung disease set up does not end in tubercle in all cases, whether it is not a tubercular process from the commencement, or whether it does not remain a separate disease throughout its course. Taking an impartial view of the matter, we may assume that, in some cases, tubercle is absent, and that in the majority of cases at the beginning, the affection is not due to the presence of the bacillus; it is certain, however, that cases generally end in tubercular phthisis. It will not be going beyond the evidence, therefore, to assume that such occuptions set up a condition of the lung in which the tubercle bacillus finds it easy to enter and to obtain foothold. Such occupations then may, without too great assumption, be held to increase the susceptibility to consumption. We find, from the writings of the best authorities, that it is only dust which may be considered to be sharp and angular, and which, of necessity, is the most irritating, which tends towards lung affections, for at the top of the list are placed the flint workers, needle polishers, file workers, and brush makers, whilst cement makers, potters, masons, and bakers do not seem to be over much affected by their occupations.

From examination of the statistics of the Victoria Park Hospital, however, we do not find that the dusty occupations form a very large percentage of the whole

number. Dividing all cases into two great divisions of outdoor and indoor occupations respectively, we have obtained the following results :—By far the larger number of consumptive people engaged in outdoor employments are the labourers. Next in order, but a long way below, come the carmen and those who describe themselves as "porters." These occupations, it will be noted, are precisely such as entail exposure to all kinds of weather and frequent risk of "catching cold," coupled with fluctuating activity in the amount of work and wages obtainable. Many of the labourers and porters, in London at least, are compelled to lead a "hand-to-mouth" existence, and although on a yearly average they may be able to make their way, it is often only too obvious that their circumstances from time to time become very wretched.

Added to this, it must be remembered, the very irregularity of occupation, the uncertainty of food, and the general mental depression, to which such circumstances are sure to lead, are too often remedied temporarily by alcohol, either in the form of beer or spirits, neither of which are obtainable by the very poor in anything but the lower quality. Physical and mental depression are thus added to conditions of risk, and are only counterbalanced by the extra amount of open-air life. It is a striking fact that amongst well-to-do outdoor workers phthisis is a rare disease.

The dusty occupations are followed for the most part indoors or in confined spaces, and amongst all classes of patients examined, the proportion of those employed in such occupations as stone working, grinding, etc., is by no means prominent. Of nearly 500 cases taken at random, the head of the list is taken by the clerks, while next to them in order come the carpenters and cabinet

makers, the warehouse and shopmen, the boot makers and the printers.

It will be noted that all these occupations involve a more or less cramped position during many hours, or the confinement in close atmospheres. The large number of cabinet makers suggests the influence of dust, but no evidence is forthcoming to show that the inhalation of fine wood dust exercises any permanent effect upon the lung tissue, as is the case with coal, iron, or other mineral dust. The preponderance of this trade in the statistics of tubercular disease may possibly be local. A colony of workers in the cabinet making trade might possibly number several consumptives amongst them, and it is not difficult to find a means for the diffusion of the bacillus when one reflects upon the almost universal habit amongst carpenters of moistening their hands with saliva.

Of the following more or less dusty occupations we have not been able to find more than one or two representatives of each class, viz., skin dressers, corn factors, brass workers, paper mill hands, cutlers, bakers, file cutters, brush makers, millers, stone-masons, and sawyers. In both indoor and outdoor classes almost every conceivable trade or occupation is represented by at least one consumptive patient.

Special interest attaches to the absence of tubercular disease amongst the hands engaged in paper mills, and for this reason. Most of those employed are young persons who are just at the most susceptible age for the reception of tubercular disease; they have to work for many hours daily in a dusty atmosphere engaged in the sorting of rags, such as old towels, old pocket handkerchiefs, and other articles of clothing which are especially liable to be infected with dried tubercular mucus. The

dust produced is dense, and cannot fail to be inhaled. Notwithstanding these conditions it was found, as the result of an inquiry set on foot some years ago by one of us, amongst the principal paper mills in England and Scotland, that no special proclivity to tubercular disease or lupus could be traced in connection with any of them. It should be noted that in all the best paper mills the rag-sorting rooms are large, airy, and well ventilated, and although the atmosphere is at all times heavily charged with dust, there is at the same time an abundant change of air. The influence of ventilation in this as in other in-door occupations deserves close consideration. Evidence is frequently forthcoming to prove that tubercular disease of the lungs is more often present in ill-ventilated work-shops than in those supplied with plenty of fresh air, irrespective of the number of workpeople employed. Overcrowding would not appear to have much evil effect provided that it be compensated by abundant and sufficient change of air, or, in other words, proper ventilation. Just as a shoal of fish will live and thrive in a pool of water through which a stream is constantly flowing and will become diseased when that stream is stopped, so a crowd of workpeople will do their day's work and maintain good health in a confined space through which a stream of air is diffused, but will as surely begin to fail in health and flag in their work directly that stream is diminished or stopped. If some of such people be already infected with tubercle, or have within them a dormant focus of disease, the ill-health produced by the defective supply of fresh air cannot but favour the chances of the further development of the tubercle. Overcrowding is only of itself dangerous in so far as it gives greater facilities for direct transmission of the tubercular virus, as we have already shown as a possible explanation of the

prevalence of the disease amongst the carpenters in the East End of London.

What is Meant by Susceptibility.—Susceptibility to a disease means imperfect power of resistance to its exciting cause. In all cases of phthisis the resistance to the attack of the bacillus has obviously been insufficient. But although this is the case, it does not follow that the power of resistance has been equally weak in every case. One individual may be so susceptible to the attack that he may surrender to the first onslaught, whilst another only succumbs after prolonged and stubborn resistance. In other words, the susceptibility or power of resistance varies enormously in different cases and under different circumstances. Every one, indeed, may be said to have what has been aptly called a different "*resistance potential*"—and this may be raised or lowered by circumstances. One man begins life handicapped, as it were, by the possession of a low resistance potential, but the circumstances of his condition may be such that his potential is never lowered sufficiently to allow of its being overcome by the bacillus; another begins life with a high potential, but this is lowered by circumstances even below the point of successful battle with the micro-organism. If this notion be true we may suppose that the susceptibility in each case may be artificially increased or diminished, and that under ideal conditions it may be brought practically to zero.

Susceptibility = low *resistance potential*, and immunity = high *resistance potential.*

The Influence of the Dose of the Tubercular Virus.—There is, however, another highly important factor which must be considered, viz., the *dose of the poison* to the influence of which the individual is subjected, or, in other words, the number of tubercle bacilli introduced into his

body. It is clear that, other things being equal, a large dose is more likely to be operative than a small one, and a resistance potential capable of guarding against a weak or small dose might succumb to a larger or stronger dose. This has actually been proved by experiment on animals; in every case, as we mentioned in the last chapter, there is a minimal dose that is effective, than which anything smaller is apparently inoperative. It is clear, then, that environment may be injuriously operative, not only in the direction of diminishing the resistance potential, but also in subjecting the individual to larger, more concentrated, or more virulent doses of the poison. It is possible, for example, as we before suggested, that a dusty occupation in which free ventilation is impossible may be injurious, because the respired air is highly charged with the specific micro-organisms. A healthy person may be considered as one immune to small, ordinary, or even medium doses of the poison, but as in the case of animals, *no kind having been found to be absolutely immune to the disease*, so we are bound to assume that absolute immunity does not exist among mankind to sufficiently large doses of the micro-organism.

Differences in the Resistance Potential of Different Tissues.—Again, it must not be forgotten that when susceptibility is spoken of, susceptibility of the individual tissues is after all implied. General susceptibility simply means the sum of the susceptibility of the tissues.

The power of resistance may also be supposed to include the resistance of the tissue at the seat of attack as well as the resistance of each of the tissues, including the blood, with which, in turn, the bacilli come in contact.

The usual medium for the introduction of the bacilli is undoubtedly the breathed air, and the respiratory mucous membrane is, therefore, that which in the ordinary course

of events is first exposed to attack, and which must first of all succumb. Some would have us believe, and their contention *may* be a right one, that a perfectly healthy mucous membrane—that is to say, one unaffected by previous catarrh, or the like – may be relied upon to successfully resist the onset of the bacilli, however numerous. If this is the case in man it is, at any rate, not so in animals, since the original experiments of Koch, which have been since repeated, showed that healthy animals subjected to a spray containing the bacilli in large quantities in due time became tubercular. However, it seems reasonable to suppose that an intact mucous membrane has more power to resist the entrance of the bacilli than one more or less disorganized, and perhaps in part denuded of its covering epithelium. But this is not all. That the respiratory mucous membrane is the one most prone to the attack of the bacilli, as shown by the greater prevalence of pulmonary tubercle than of tubercle of other internal organs, has been explained by the fact that the bacilli are most often introduced with the air. It appears from recent feeding experiments, however, that this is not the *only* cause. The intestinal mucous membrane in a healthy condition seems to possess much more power of resistance than the pulmonary. Another example of the different resistance power of different tissues is seen in the case of experimental inoculations of tubercle bacilli. The seat of the inoculation is of the greatest importance with respect to the effects produced; subcutaneous inoculation being frequently inoperative, whilst intravenous inoculation is the most quickly, and if of sufficiently large amounts, the most certainly fatal.

These few considerations will serve to show how very complex is the whole subject, but they also indicate that

however great the susceptibility to the disease may be, as for example, in the case of strong hereditary taint, supposing the conditions of life be such that on the one hand this susceptibility is not increased, and, on the other, that no concentration of the poison be allowed to operate, tubercular phthisis may be avoided.

Of what does the Susceptibility Consist?—To the bacteriologist must be left to settle the question whether the susceptibility of each particular tissue consist of its special chemical composition favourable to the growth of the bacilli, or of a more subtle vital action in connection with the corpuscles fixed or moving, or with the fibres of which the tissues are made up.

Preventive Treatment.—We may derive very valuable indications for the prophylatic or preventive treatment of phthisis from the foregoing considerations. These may be summarized under the following heads:—

(*a.*) The diminution of the risk of infection by the maintenance of healthy surroundings.

(*b.*) The careful protection of those who have inherited or have acquired a susceptibility to tubercular infection by endeavouring to keep up a high standard of general health on the one hand, and, on the other, to procure, as far as possible, complete resolution of any disease from which they may have suffered.

a. Diminution of the Risk of Infection.

Source of the Tubercular Virus.—As the tubercle bacilli are derived only from those affected with tubercle, and do not, as far as we at present know, multiply outside of the animal body, except when artificially cultivated as saprophytes, it follows that if we wish to diminish the tubercular virus we must concern ourselves primarily

with all those, whether human beings or animals, affected with tubercular disease. These are the foci of infection. From these foci the tubercular poison is disseminated. The principal vehicles of infection appear to be the excreta, the urine, fæces, and particularly the sputum of the tubercular. For although, as has been admitted, *direct infection* of the healthy by the breath of the phthisical is not without the bounds of possibility, yet from physical causes the expired air is not likely to contain any large number of bacilli unless violently discharged by an expiration of the nature of a cough. It is stated that experiments have proved the uninfectious nature of the breath of the phthisical, but these experiments have not been sufficiently exhaustive to be considered conclusive.

There is no reason, however, to doubt the dictum that *direct infection, even if possible, is exceedingly rare.*

On the other hand, the sputum of the phthisical very often swarms with bacilli, and each individual under such circumstances in the two or more ounces of expectoration ejected in twenty-four hours, must be responsible for setting free upon the community of millions of tubercle bacilli. When we consider how short a time has elapsed since we first began to consider the excreta of phthisical patients dangerous, it is not a matter of wonder that phthisis has been, and yet is, an ubiquitous disease. Having now come to recognize that the *chief source of infection is the sputum*, many of us, and those particularly connected with hospitals for chest disease, have been endeavouring to alter the previous careless disposal of the excreta of tubercular persons. The first step in the endeavour to diminish the risk of infection is to recognize that each phthisical person is a danger to his fellows, and to treat him as such.

Precautions as to Disposal of Sputum.[1]—Rules for the treatment of the expectoration must be made and enforced as far as it is possible. As we have explained in the last chapter, the most danger resides in the sputum when it is dry, as it then is easily pulverizable, and may be disseminated as dust. This dust has been proved by competent experimenters to retain its infective powers

[1] *City of London Hospital for Diseases of the Chest, Victoria Park. Suggestions for the Guidance of Consumptive Patients.*

"(1) It is certain that the material (or 'phlegm') coughed up by persons suffering from consumption contains the seeds of the disease.

"(2) The phlegm, therefore, should not be swallowed. Such a habit may lead to consumption of the bowels.

"(3) Consumptives should not, when indoors, spit about the floor, but should spit into special spitting cups (or pots), half full of water.

"(4) The spitting cups should be emptied into a bright fire or into the pan of the water-closet, but never anywhere else, and especially not into the dust heap. Out of doors a pocket-handkerchief may be used, but all soiled handkerchiefs should be boiled for at least five minutes when they are being washed.

"(5) The room in which a consumptive lives by day or by night should be well aired, and the windows should be thrown wide open as soon as the patient leaves it. The windows should always be kept a little open at the top, both by day and by night. The chimneys should not be stopped up, but should be freely open for the passage of air. The floors of the room should be kept very clean, and great care should be taken that no dust remains upon them. They should be cleaned with a wet cloth.

"(6) Consumptive patients ought to sleep by themselves.

"(7) Mothers who are consumptive should not suckle their children, and should not themselves make use of the children's feeding bottles, cups, spoons, etc.

"These suggestions are not alone made for the benefit of sufferers from consumption, but also in the interests of the family, for by adopting these means the spread of consumption may be prevented."

Similar suggestions have been drawn out at several of the other Chest Hospitals in this country.

for long periods. Why the dried sputum has this property we are unable to say; whether the tubercular bacilli form spores or not is uncertain, very eminent bacteriologists denying the supposition, but the fact remains that dried and powdered sputum retains its infective power for long periods. We cannot accept the idea suggested by Dr. Ransome[1] that such bacilli "may actually *increase in virulence* during a sojourn for a time in a medium external to the body—either in polluted ground, air, or in an atmosphere saturated with aqueous vapour from the lungs," without the production of experimental proof in its favour. A very elementary precaution is to prevent the sputum from drying up, by causing the patient to expectorate into a suitable vessel, in which several ounces of a liquid disinfectant, or of water, are placed. The disinfectant which is cheapest and as powerful and free from danger as any, is a 5 per cent. solution of commercial carbolic acid. The patients must be directed never to spit into pocket-handkerchiefs, or upon the floors, but always into this receptacle—the contents of which must be burnt. The body linen must be thoroughly boiled, and the pocket-handkerchiefs particularly need careful attention in this respect, as the patients have in all probability used them to receive the sputum. The cleansing of rooms in which the phthisical live should be carefully attended to, and should be done so that there is no dust. If possible, the walls should be painted, so as to be capable of being wiped with a moist cloth or washed down from time to time, and the floors should have no carpets and should be polished or evenly planed, and should be scrubbed with antiseptic soap. Then it is advised that the clothes of patients who have died of phthisis should be burnt, and the room or rooms

[1] *Loc. cit.*, p 101.

disinfected as though the disease had been scarlet fever or small-pox. It is only by such attention to the individual cases of phthisis that the dissemination of the tubercle bacilli may be stopped. Already such precautions have begun to bear fruit in Germany, where in certain districts the mortality from consumption is distinctly diminishing.[1]

[1] *Hints to Prevent the Spread of Consumption.*—The following useful hints have been circulated by Dr. Huggard, of Davos, for the information of tubercular patients:—

All cases of tubercular disease of the lungs ("consumption") take origin directly or indirectly from other cases. This is now an established fact. Infection, however, is easily provided against if certain simple precautions are taken.

The chief modes of infection are—

(1) By inhaling dried and pulverized expectoration.

This is apt to occur when an ordinary pocket-handkerchief is used by a tubercular person for expectoration. When such a handkerchief is opened the dried expectoration is likely to be pulverized and diffused through the air. Thus it may be inhaled by others as well as by the patient himself, who is likely to suffer from drawing disease germs into portions of lung previously unaffected.

Another source of pulverized expectoration is the habit of spitting on the ground. The expectoration becomes mixed with dust; and then is easily carried into the air. This habit, therefore, is not merely offensive but dangerous.

(2) By using spoons, cups, and other articles of the kind which have not been properly washed after having been used by tubercular persons.

(3) By kissing.

This source of infection is especially to be guarded against in the case of children.

Self-infection may occur, in addition to the ways mentioned, by swallowing the expectoration. This habit is likely to lead sooner or later to infection of the intestines with tubercular disease.

Knowing the channels of infection we can easily take effective precautions.

The sputum must be destroyed and must not be allowed to become dry.

Next to the care that no fresh bacilli shall be distributed broadcast, we have to deal with the cleansing and ventilation of dwelling-houses which have been occupied by patients with tubercular disease of the lung. It has been suggested that many of the houses in the lower class districts of large towns for example are too bad for improvement, and should be utterly destroyed, to make way for healthy dwellings, and until this is done, one very

A spitting cup or flask containing just enough disinfectant solution to cover the bottom of the vessel should always be used for the expectoration. Out of doors a pocket spitting flask, such as Dettweiler's, should be employed.

Pieces of linen or calico about ten inches square may also be carried. These should be used only in case of absolute necessity; and should be burnt as soon as possible afterwards. No piece should be used more than once.

Bedrooms that have been occupied by tubercular patients should be thoroughly disinfected before they are occupied by other persons; and a declaration or assurance on the point should always be demanded.

If the previous occupant of the room never allowed the furniture, hangings, or carpets of the room to be contaminated with the sputum, there would be little need for this precaution. But as people, ordinarily of cleanly personal habits, sometimes show a surprising amount of ignorance or carelessness in this respect, the following points should be insisted on:—

(1) Carpets, curtains, and bed-coverings should have been exposed to superheated steam under high pressure.

(2) The floor and walls of the room should have been properly disinfected. (Rubbing with new bread followed by the application of corrosive sublimate solution is probably the most effective practical method.)

There is no danger of infection from the breath of a tubercular patient. The sole danger of social intercourse arises from neglect of the precautions described.

Fresh air is of the highest importance for tubercular persons. Hot and stuffy rooms have an evil influence over the disease. Except in special circumstances the bedroom window should be kept open by night as well as by day.

pregnant store-house of the bacilli cannot be efficiently dealt with.

All dirt is a possible source of infection.

Of course, if it were possible to isolate all cases of phthisis in hospitals or other suitable dwellings where all the precautions for dealing with all excreta—not only the sputum, but also the urine and fæces, which have been shown in certain cases to contain tubercle bacilli - are rigidly enforced, a considerable amount of the tubercular infection of the population would be obviated. Another source of the dissemination of the tubercular virus must not, however, be forgotten, viz., the tubercular diseases of the animals from which part of the food supply is obtained. Milk from tubercular cows has been shown to contain the bacilli, as has also the meat derived from the same source. It is obvious that if this important matter be neglected we shall be overlooking a grave danger, although possibly one not so great as might have been imagined. As we said before, the intestinal mucous membrane offers more resistance to the entry of the bacillus than the pulmonary, even in the cases in which milk and meat of distinctly infective character are ingested. The stomach also contains a powerful germicide in its acid juice. We are not, however, free from risk in this direction until a proper supervision is exercised over the farms and dairies from which so large a proportion of our food is derived.

Another source of the dissemination of tubercle bacilli is possibly—already briefly alluded to in the last chapter—to be traced to tubercular disease of the domestic animals, and of other animals, hardly of this class, but still sometimes kept, especially by children, as pets, such as guinea-pigs and rabbits. The mere mention of such a possible cause suggests that suffi-

cient supervision in this direction should always be exercised.

THE QUESTION OF TUBERCULAR FOOD.—The relative danger arising from the use of milk and meat taken from tuberculous animals has recently been indicated in a manner which may be regarded as authoritative by the Report of the Royal Commission on Tuberculosis. The labours of that Commission have extended over five years, and the experimental, and indeed the major, part of the work upon which the Report is based has been carried out under the able supervision of Dr. Sims Woodhead and Dr. Sidney Martin.

These observers have now proved conclusively that the meat derived from a tuberculous animal is capable of setting up tubercular disease in susceptible animals, even when no symptoms of tubercular disease can be recognized with certainty in the animal from which the meat was taken. They have further shown that the danger increases in proportion to the amount of disease affecting such animal. In other words, the stronger the dose of poison, the more liable is the recipient animal to the disease which it induces.

In the case of milk they have made it clear that the danger lies in the udder from which the milk is drawn. Milk taken from a healthy udder in a tuberculous cow was found to be innocuous, but if tubercular disease of the udder itself was present the milk was found to be infected, and was then capable of setting up virulent tubercle, whether the susceptible animals were fed or inoculated with the milk.

As in the case of meat, the more the active disease in the supplying animal the more striking were the results produced in the receiving animal. Not only milk, but also butter, skim-milk, and butter-milk derived from a

tubercular udder were found to contain infective tubercular material. To these important facts must be added two others of equal interest from the point of view of practical treatment:—

I.—The infective disease of the udder is capable of infecting the milk from the very outset of the disease and before recognizable lesions in the udder have been induced.

II.—Veterinary science has not yet discovered any positive means of recognizing such disease in the earliest stages.

If, therefore, we have no means of positively proving that milk is derived from a perfectly healthy source, it becomes the duty of the medical adviser, especially when dealing with patients who may be assumed to have a "low resistance potential," to look upon milk as a constant source of danger and to frame his advice and treatment accordingly.

The Commission Report has fully confirmed the views that have already been enunciated as to the safety that may be insured by boiling all milk used for human food. The Report makes it clear that exposure of milk to a boiling temperature, if only for few moments, renders it non-infective, and it follows that, with the knowledge of the foregoing facts, no hesitation should be felt in condemning the use of raw milk by children and tubercular patients of any age. That such wholesale condemnation must be met at first with a good deal of opposition is only to be expected, but in course of time it may very well happen that the practice of drinking raw milk will become as rare as is now the practice of eating raw meat.

As regards the precautions to be taken in the case of meat, the Report of the Commission goes to prove that absolute protection is not afforded by the ordinary pro-

cesses of "cooking." The temperature that suffices for ordinary roasting or baking of a "joint" is not sufficient to destroy the vitality of tubercular virus if it be lodged in the deeper parts, although the surface of the cooked meat is rendered quite non-infective thereby.

Thus, while an absolute safeguard exists in the case of milk, no such ready means of protection is at hand to render meat non-infective. It must of necessity be left to legislative control to provide for the regular inspection of meat and the condemnation of all that may possibly contain tubercular virus.

Uncooked meat is but rarely used in this country, but meat essences, which have been prepared without the use of heat sufficient to destroy the tubercular poison, are not uncommonly supplied for the use of invalids. No evidence is as yet forthcoming to prove that such essences ever contain tubercular virus, but the possibility of such an occurrence cannot be disregarded.

It is satisfactory to learn on the authority of the Commission that even incomplete cooking has the effect of diminishing, even though it does not annul, the infective quality of the tubercular virus.

b. Protection of those particularly susceptible to the disease.

This part of the subject naturally divides itself into two, viz., the protection of those whose susceptibility is *inherited*, and the protection of those whose susceptibility is *acquired*.

Of those in whom there is Hereditary Susceptibility.—It must be remembered that tubercle itself is not inherited, although a few authenticated instances have been recorded indicating that this is possible. Of these Fränkel says ("Grundriss der Bakterienkunde," translated by J. H. Linsley, M.D., New York, 1891)—"Not a single indubit-

able case of congenital tuberculosis (established before or during birth) has thus far been observed in *man*. Johne and Malvoz have, it is true, found tubercle bacilli twice in cattle in the organs of embryos. The hereditarians of the strictest order have for years danced most enthusiastically around the calf described by Johne" (p. 249).

That which is inherited is the susceptibility to the disease. This may be strong or not strong, according to circumstances. Our chief concern must be so to treat children whose parents are phthisical as to prevent the susceptibility from becoming operative. This must be particularly the case when one or more children of the family have shown signs of tubercular disease. Our task, under the latter circumstances, is to protect the remainder from becoming infected.

Short of the prevention of the marriage of phthisical people—a thing theoretically admirable, but practically impossible—we must commence our protective measures with the children at birth. The earliest proceeding of all is to prevent a phthisical mother, or one constitutionally delicate, from suckling her offspring. In the place of the mother that which is much recommended is the substitution of a wet nurse, but it must be confessed that a strong prejudice exists against such a method. If, however, such may be overcome, a strong, healthy young countrywoman should be chosen. Failing a wet nurse the child should be brought up by hand, that is to say, should be fed by means of the bottle. As a substitute for the mother's milk, properly-diluted ass's milk, goat's milk, or cow's milk may, in the order of excellence, be administered, but should in all cases be sterilized by boiling for a few moments. Generally speaking, the addition of some lime-water, sugar, and salt is necessary. The

humanized milk supplied by the Aylesbury Dairy Company is often of considerable service in the bringing up of hand-fed, delicate infants. But many kinds of food, as long as they contain no carbohydrate of the nature of undigested starch, are almost equally good, of which may be mentioned condensed cow's milk, whey, and cream.

When the child reaches the age of six months it is allowable to increase the food by the addition of small quantities of thoroughly well-ground oatmeal, or of such patent foods as Savory and Moore's, Mellin's, or the like, and at nine months to a year, varying somewhat according to circumstances, gravy from underdone mutton or beef, with bread crumbs, may make the mid-day meal. At a year we strongly advise the administration of some underdone lean mutton or beef, pounded, chopped fine, or pulled to shreds by means of a couple of forks, and throughout the life of the child the amount of meat in the diet should be considerable.

Well-boiled milk and bread, or porridge with plenty of milk, should be given for breakfast and supper, and at other periods of the day the child should be encouraged to take plenty of good milk. On the other hand, pastry should not be allowed, as certain to tend to indigestion, and sweets only of the simplest kind permitted. Fatty foods may be given if the child can take them; few object to bacon, but, as a rule, children at all inclined to be delicate cannot really digest meat fat, although they can take fat in milk, cream, butter, and cod-liver oil. We shall have more to say in a later chapter about cod-liver oil, but here we would advise small doses, viz., a teaspoonful each morning a quarter of an hour after breakfast, and another after dinner, to a child showing the slightest tendency to debility or marasmus. We must

recollect, however, that the susceptibility we have to deal with is something much more subtle than rickets, which is a disease essentially due to improper feeding.

Next to proper feeding comes the importance of plenty of *air* and *light*. In this respect a child is like a plant, it cannot attain its full growth or development without air and light, and a tubercular child, or one potentially tubercular, requires them more than one more robust. Of course the ideal condition for a child is, to be brought up in the country, free from the smoky and murky atmosphere of a town, where the air is purer and the sun's light less obscured than elsewhere. The country, then, is, *cæteris paribus*, better than the town, and of country districts those near the sea (the north-east coast of Kent being particularly good) or high up in the hills are to be preferred.

If, however, a country life is not practicable, care should be taken that the child has as much of the open air as possible, and when he gets a little older, anything in the nature of open-air games should be encouraged. Whenever opportunity occurs it is well to take such children into the country, or to the sea-side, for a change of air even if it be for a few days only. Special advantage should be taken of the summer or autumn holiday to encourage out-of-door tastes and habits. At the seaside the vast majority of children obtain rapid and marked benefit. Paddling in sea water with bare legs cannot be recommended, but regular bathing, and later on swimming, are by all means to be advocated, but watch must be kept to note the effects produced and to guard against incautious over-indulgence. Bathing in very cold water and staying too long in water at any temperature, especially on dull, chilly, or overcast days, are all apt to be followed by catarrhs, even to those in

health, and still more frequently in the case of delicate children. So long as bathing is followed by a satisfactory "after-glow" very little harm is likely to follow, but if the child be found to be cold and shivering, such bathing should be promptly stopped.

At the same time it should be recollected that such children are, as a rule, very apt to take "chills," which may seriously disturb the functions of the liver, so that warm clothing, with flannel or woollen garments next the skin, are a *sine quâ non.*

As regards young children, it is a doubtful point as to whether they shall be taken out in cold, damp, windy weather. East and north winds, and north-east winds, frequently produce catarrhs and "chills," and caution is therefore necessary to avoid such complications. Warm gloves, woollen stockings, and good, well-made boots with stout soles should always be worn. Cold air is not, however, *per se* a contra-indication to open-air exercise, and bright, sunny, frosty weather is, if proper precaution against catching cold be taken, decidedly beneficial.

Next as regards the rooms in which children live by day and by night. They should be large, lofty and light, should have preferably a south aspect or, possibly, a west, never a north situation. The day nursery should be thoroughly well ventilated every evening after the child has gone to bed, with well-opened windows, and with the fire kept in for a time. In the same way, the night nursery should be aired during the day, but the temperature should not be very different to the day-room. On general sanitary principles, these nurseries should be well removed from water-closets and sinks.

If the child survive and continue healthy during early years, the same kind of precautions have to be taken in boyhood or girlhood, but regular exercise with light dumb-

bells, ordinary drilling, and such games as skipping, playing at ball, and such like, are of importance, both in expanding the chest and in developing the muscles. Later on cricket, tennis, rowing, fives, and other outdoor games have the same good effect. It is unnecessary to specify the exact *clothing* to be worn by girls and boys. The only general principles which should be observed are, that the articles of dress should be warm, should be made chiefly of woollen materials, and should be as light as possible.

Again, one is asked as to boys who are potentially delicate, should they go to a boarding-school, and later on to a public school? The reply which should be made, of course, depends upon circumstances; but speaking generally, supposing it is possible to ensure that in a boarding-school a proper supervision is exercised as to health, and that the school itself is well built, well situated, at the sea-side or in the real country, one may reply in the affirmative. Day schools are not to be recommended, since the number of pupils is usually out of proportion to the room accommodation, and the consequence is that the rooms, in which so many hours are spent per diem, are stuffy and ill ventilated. That such is the case anyone may convince himself if he go into a Board School-room, in the construction of which attention to ventilation and other sanitary requirements may be said to have been given, yet in such a room in a couple of hours the atmosphere is dense and stuffy. Whether at school or at home, too many hours continuous work per diem, and too long lessons, should be deprecated.

At last comes the question, supposing the school life has been passed through with success as far as health is concerned, as to *the kind of occupation* it is best to recommend, and this is one which can only be answered upon

general principles, such as, that an open-air life is one to be preferred to one more sedentary, and that a country life is likely to maintain the health better than a town life.

Much is talked nowadays of fruit-farming in Australia and California, and cattle and sheep ranching in Australia, America, and elsewhere. From all accounts such a method of living presents so many of the features of a healthy life that, if the individual can stand the hardships of it, it might be recommended. A word of caution must, however, be given to any "potentially tubercular" person who may contemplate this line of life. Although he may rely upon finding a climate which will in all probability suit him far better than his native air, he cannot rely upon success in the business which he may adopt as a mode of earning a livelihood any more in sunny climes than in damp and cloudy ones. Hence a careful calculation should be made beforehand of the relative chances of success or failure in the locality selected for residence before embarking upon any farming or fruit-growing speculations. That this consideration is not one which affects the pocket alone has been abundantly proved in the case of many young men, with consumptive tendencies, who have started rashly in such pursuits, for which they have had no preliminary training, and in whom the disappointment of the inevitable failure in business has led to rapid failure of health and to activity of the tubercular disease. Among out-door occupations at home, farming may be mentioned, although of late years it has ceased to be very lucrative. It necessitates abundance of fresh air and exercise, and if only the farmer will work with his men he may rely upon maintaining health, if it be possible, and will materially increase his chances of success financially. The life of a sailor may be recommended in special cases, but the risks of sea life are

greater to the potentially consumptive person than those of an inland occupation. The occupations to be avoided by such persons are those which involve exposure to dust in confined spaces or to sudden variations of temperature, those in which a cramped condition of the body for long periods is necessary, and, above all, those pursued in rooms or houses in which the ventilation is likely to be defective.

Whatever occupation, however, is selected, sufficient, but not too excessive, muscular exercise in the open air for as long a period as possible daily is highly important. Let us again repeat, cricket, football, riding, rowing, swimming, gardening, farming, cycling, gymnastic exercises are all to be encouraged if indulged in in moderation.

Such, then, are a few of the chief principles to be observed in the protection of those who are potentially, by inheritance, susceptible to the attacks of the tubercle bacillus.

Of those whose Susceptibility is Acquired.—With reference to the classes of the community who acquire a susceptibility to tubercular disease of the lung, we, unfortunately, seldom have an opportunity of preventing the operation of the causes producing the susceptibility. We only see the effects in that the individual with no inherited tendency has succumbed to the attack of the bacillus. But the prolonged operation of its peccant circumstances may be prevented by withdrawing the individual from unfavourable surroundings; alteration of occupation, better houses, country life, purer air, good food, exercise in the open air, and the like may diminish the chances of further infection. We shall return to the subject when considering the treatment of early phthisis. We must be most careful in all cases, but particularly in the case of those in whom a susceptibility may be sus-

pected from family tendency, to see that there is complete convalescence from any disease before allowing the patient to return to his ordinary occupation. Great care is needed during recovery from fevers, such as typhoid, measles, whooping-cough, or influenza, and careful and prolonged treatment is necessary in cases of lung and pleural disease, and regular supervision for a long period after apparent recovery.

The possibility of storage of tubercular material in bronchial and other glands must never be forgotten. More detailed reference as to the precautions necessary in view of such a possibility will be found under the heading of "Complications."

CHAPTER V.

THE DETECTION AND TREATMENT OF EARLY PHTHISIS.

The Onset of Phthisis: its True First Stage.—At last the time arrives when the power of resistance of the patient's tissues to the attack of the tubercle bacillus is at an end, the tubercular processes begin in the lung and the disease enters upon its true first stage.

The *symptoms* manifested under such circumstances vary very greatly, and chiefly with the activity and extent of the tubercular infection. Speaking quite generally, however, the onset of pulmonary consumption is insidious, and for some time the symptoms of its presence may be obscure and little distinctive. Not infrequently the disease of the lung is discovered quite accidentally—on the occasion, it may be, of a mere *pro formâ* examination of the chest undertaken for life insurance or what not. This is not of course always the case, as sometimes the onset is sudden enough, and the disease is heralded by a severe attack of *blood-spitting*, "breaking a blood-vessel" as it is called by the patient or his friends. Of other symptoms which are significant we must put first, as the most important, *wasting*, coming on without any apparent cause, general and steady, accompanied, it may be, by no alteration of the appetite or other indication of deranged nutrition. It is seldom that the wasting remains the only symptom, as a general rule with it there is some little *cough*, with or without expectoration. After a little time, measured by weeks or months, the cough becomes a

prominent feature of the case, and it is frequently found that the patient dates his or her illness from the onset of the increase of cough, the result it is thought "of a neglected cold," since the preceding wasting has not been sufficiently objective to be noticed. Coupled with wasting and cough, the appearance of so called *night-sweats* is very suggestive. These sweats come on during sleep, whether by night or by day, and are often excessive, almost saturating the patient's night garments (see Chapter IX.). With them there is generally more or less *fever*.

A very important series of symptoms, too, may usher in the very earliest stage of tubercular disease of the lung. These are the symptoms indicating *disorder of the digestive system*. They are frequently present to a greater or lesser degree. It is often noticed that those affected with early phthisis have suffered for months, or possibly for years, from dyspepsia in some form or another, the symptoms of which are sometimes very aggravated. Those which are most commonly present are:—Pains in the chest and stomach and peculiar craving for food, which craving, however, is soon satisfied and as soon reappears after a meal; uneasiness, utter weariness, or apathy, with disinclination to concentrate the attention upon anything but the symptom of the hour. These, coupled with an extraordinary irritability of temper, necessarily should put us on the alert, as they form a combination of ill omen. A considerable amount of interesting discussion has taken place as to the exact relation of this dyspepsia to the lung disease. Is it a cause or a result of the disease? is it a symptom of the invasion of the tissues by the bacillus, or is it a symptom that the tissues are undergoing such a change that their power of resistance is being taken from them?

To these questions we propose to return later on (Chapter VIII.).

Physical Signs of Early Phthisis.—We see that the presence of any of the symptoms above referred to renders it not only advisable but necessary to make a careful examination of the chest in search of physical signs that might indicate the presence of actual disease.

The first and most striking change that is set up in any active organ by acute disease is some form of disturbance of its function. The disturbance may at first be either increase or decrease of activity. When the apex of a lung has become the seat of active disease, the common functional alteration to be detected is a local diminution of the fulness of the inspiratory act. This may show itself by a visible impairment of expansion as compared with the opposite side or by the more delicate auscultatory test of inequality between the inspiratory sound on the suspected side and that of its healthy fellow. If early disease is present the inspiratory sound is, as a rule, in the first instance, lessened in volume. Later on a wavy character may be given to the sound produced on the entry of air, the lung being apparently expanded in a series of jerks instead of in a single steady movement. This jerky inspiration must not be confused with the condition in which the inspiratory movement is interrupted by the contractions of a large or violently acting heart. The "cogged" breathing due to impaired movement of the lung is not synchronous with the heart's action. If the earliest stages are already past, the breath sounds over the affected area become further modified by increase in the volume or length of the expiratory sound, and with it some slight alteration or increase in the vocal resonance. Occasionally the functional activity of the lung is so far disturbed that feebler respiratory sounds are heard all

over the affected side and not at the apex only. This latter sign, if present in conjunction with rapid wasting, rise of temperature, or other indications of active mischief, must be regarded as indicating a widespread infection of the lung with tubercle, thus rendering the case a serious one from the very beginning.

The physical signs of dulness on percussion, increase of vocal vibration, etc., are, as a rule, only present when the disease has passed beyond the incipient stages. Crepitation on the other hand, especially when accompanying the inspiratory movement of the lungs, is sometimes to be heard very early in the disease. This crepitation may vary in volume and extent from day to day, but as a rule the sounds are fine and small, generally accompanying inspiration only, and frequently increased for a few moments after the act of coughing.

As regards other and less constant physical signs which are very properly taught by instructors in auscultation as indicative of early tubercle of the lung, we may say that they do not, if present, add very much to the evidence of the disease obtained from the symptoms and signs already enumerated, since they are found, generally speaking, in conjunction with these signs, and their absence would not be sufficient to invalidate the diagnosis arrived at by other means. One of such signs, however, may be mentioned, *i.e.*, the existence of the so-called *subclavian murmur.* This sign is said to be caused by the pressure of a consolidated apex-tip upon the subclavian artery, producing a "fluid vein," and so a murmur. If it be present, and it is true that it is sometimes present very early in the history of the case, it may be considered as strengthening the diagnosis of considerable apical consolidation. It is, however, by no means a constant sign.

In order to make the diagnosis absolutely certain the sputum must be carefully examined for the *presence of tubercle bacilli.* Various methods for this purpose have been recommended. They are all founded upon the first method of Ehrlich, whose process soon superseded the more difficult method introduced by Koch. One or other method should be thoroughly known to every practitioner. (For these methods see p. 24).

The persistent presence of tubercle bacilli in the sputum is sufficient of itself, even without the detection of definite physical signs or symptoms, to indicate the presence of tubercle of the air passages.

The negative and complementary assertion, however, cannot be made with the like certainty, viz., that if tubercle bacilli are not to be detected in the sputum, then tubercle of the air-passages may be excluded from the diagnosis; for at least two reasons—first, because the method used to stain the bacilli may sometimes fail; and secondly, because cases of tubercular phthisis may from time to time in their history be unaccompanied by the presence of tubercle bacilli in the sputum, at any rate, not such as react to the ordinary staining methods. In addition to this a considerable amount of evidence exists to prove that cases of pulmonary phthisis do occasionally occur which are non-tubercular, at any rate for a time.

To this we have already alluded (see p. 48).

Cases occur from time to time in which hæmoptysis is the first symptom of disease of a lung which had hitherto appeared to be healthy. The subsequent manifestation of tuberculosis of the lung has often led to the belief that a form of phthisis ("ab hæmoptoë") occurs in which an actual development of tubercle takes place in blood which has been poured into the lung from a ruptured vessel. This theory rests, however, upon clinical evidence, and not

upon pathological proof. It does not explain the reason of the hæmorrhage in the first instance, and it is apt to lead one away from the very important consideration that a person who brings up blood from the lungs is probably the subject of tubercular disease, and must at any rate be treated as such. In order to accept logically the theory of phthisis ab hæmoptoë it is necessary to assume that severe hæmorrhages may take place into lung tissue, in persons otherwise healthy, from other than tubercular disease. The rare occurrence of pulmonary hæmorrhage from hydatids, or other forms of tumour within the lung, are generally heralded by other symptoms long before the bleeding occurs. It must be borne in mind that tubercular disease of the lung may begin and even advance to a considerable extent without giving rise to any appreciable physical signs, and with this fact before us it is easier to believe that the initial hæmorrhage is due to tubercular infiltration rather than that a hæmorrhage may occur from some unknown cause, and that the effused blood may become the nidus of secondary tubercular disease, although we admit that such an event is possible.

The Indications for Treatment.—Having, then, by the aid of the symptoms and signs already discussed, come to the conclusion that a patient is actually affected with incipient phthisis, we may assume, as we have elsewhere explained, first that the tubercle bacilli have actually effected a lodgment in his tissues, and secondly that the tissues were, when the attack of the bacillus commenced, in a condition of greater or less susceptibility. Susceptibility, as we have seen in a previous chapter, means a low power of resistance. The indications for treatment which may be derived from such a supposition are sufficiently obvious. They are: to stop the action of the bacilli in

the tissues either by destroying or diminishing the vitality of the former or by increasing the power of resistance of the latter.

It is easy enough to see the principles of treatment, it is quite another thing to carry out those principles to a successful issue. So far little success has followed the endeavours to destroy the bacilli in the tissues by any treatment which has been attempted. In the endeavours to eliminate the bacilli from the system as such, it has also to be confessed that failure has been the result. In the hope of staying the action of the bacilli, however, we may try various means, and very possibly with success. In early tubercle of the lung we are confronted with a condition in which the disease is yet local and in which the spread of the infection is generally by continuity. So in the commencement of the disease is there most hope of successful treatment. Our hope rests chiefly upon this, that the potentiality of the resistance of the tissues may be increased, and that it is possible to remove the patient from surroundings in which, we may reasonably suppose, the amount of the poison in the atmosphere about him is considerable, to others in which it is less.

Methods of Treatment.—For the sake of convenience we will consider the methods of treatment under two heads: (*a*) *The constitutional treatment*, which aims at increasing the resistive power of the tissues and comprises all the means we have of improving the general health, and of improving the environment of the patient with a view of diminishing the dose of the poison to the influence of which he is exposed. Although these two objects are apparently very different, we find that, generally speaking, the conditions under which the poison is reduced in the atmosphere are those also which conduce to the improvement of the general health; and

(*b*) *The antiseptic treatment*, which aims at the actual destruction of the bacilli within the tissues by the introduction of drugs and other substances which have the power of destroying or, at any rate, of preventing the growth of the bacilli outside of the body. It will be necessary for us to consider the various methods which have been employed for this purpose and to indicate the amount of success which has resulted from the employment of each of them.

(*a.*) As regards *constitutional treatment*, one of the first inquiries must be directed to ascertain the circumstances under which the patient has become tubercular, in the hope that we may be able to substitute healthy for unhealthy surroundings. We almost invariably find that among the first requisites is the necessity for purer air, and we must try in each individual case to procure this. It was well pointed out by Dr. Hughes Bennett (Mentone), himself an excellent example of what may, under favourable circumstances, be done to stay the progress of phthisis, that it makes all the difference in the world to the chance of cure whether or not the patient is sufficiently well off to profit by medical advice involving the expenditure of considerable sums of money. Where expense is no object the problem of treatment certainly becomes simplified. But, after all, those to whom expense is no object are in a small minority of the patients affected with phthisis, and as we are too often called upon to prescribe for the poor, and even the very poor, it would be of no use to suggest such expensive remedies as wintering in the Riviera. Nay, some of those affected with early phthisis, particularly patients who come to be treated as out-patients at chest hospitals, must perforce continue their usual work. In the treatment of all classes of patients, however, in this condition, the principle holds

good—we must try and change their environment, and we must try and obtain for them a purer atmosphere; suggesting to one, it may be, to leave England for the Riviera, for Davos, for a sea voyage, or the like, and to another possibly only removal from town to suburb. This latter suggestion may more often be followed even by the poor than one might on first thoughts imagine. In certain of the environs of London and other large towns a working man may find it quite as cheap to live in the country where rents are less, even although he have to come into town daily by train. The cheap trains upon nearly all the suburban railways about great cities have made it possible to the town-worker to spend the greater part of his leisure time in a purer atmosphere.

It is sufficiently obvious that the air is less laden with impurities in a suburban or semi-country place than in such a town as London or Manchester, and if patients belonging to the working-classes will change their dwellings to the extent indicated, they will certainly change for the better; they obtain better air, and even if the houses they live in are no better built, at any rate they exchange old for new houses. But on the first detection of the signs of phthisis we may often find a change more beneficial to the patients than removal from town to suburb. They may have friends in the real country who will take them in for a time, or may obtain admission to Convalescent Homes, and this temporary rest may make all the difference in their ability to struggle against the encroachments of the disease.

Thus we think that a phthisical patient very often stands the greatest chance of cure if, immediately upon the detection of his disease, he is sent to a different climate, to be chosen in each particular case with all the skill his medical man has at his command.

In the management of cases of early phthisis among the poorer classes we have yet another alternative, viz., the reception of the patients into hospital, either in town or in the country. We have for this purpose several special hospitals for diseases of the chest, of which four are in London.[1] The accommodation, however, provided in these special hospitals is very inadequate to the number of phthisical patients, and suggestions have been made that it is the duty of the State to step in and provide a proper number of beds for the isolation and treatment of pulmonary tuberculosis, just in the same way as it has provided for other diseases which are a source of danger to the community, infective fevers and the like. It is a

[1] *Hospital Accommodation for the Phthisical.*—The distribution of hospital accommodation for consumptives in England is somewhat incongruous. By far the larger number of chest hospitals are situated in large towns, and of these the principal are in London. The City of London Hospital for Diseases of the Chest, the Consumption Hospital at Brompton, the Royal Hospital in the City Road, and the Mount Vernon Consumption Hospital at Hampstead supply between them 615 beds, but of these the daily average occupied amounts only to 472, and the total number of occupants in an average year does not exceed 3,800. The only hospital out of London which devotes more than 100 beds to cases of consumption is the National Hospital at Ventnor, of which we shall have occasion to speak at greater length in another section. At Bournemouth two similar institutions supply 82 beds; at Liverpool the special provision for consumptives is limited to 44 beds, and at Manchester to 50 beds. The great Midland towns of Birmingham, Leeds, and Bradford, and Bristol, Exeter, and Plymouth in the west, do not appear to have any special accommodation, and the Northern Counties are provided with five beds at the Northern Counties' Consumption Hospital at Newcastle-on-Tyne. At Torquay in the south 40 beds are provided for cases of incipient disease only. It will thus be seen that the number of beds provided in the provinces amounts to 418 as against the 615 in the four metropolitan hospitals. In Scotland and Ireland hardly any provision exists for the special treatment of consumptive patients, but efforts are being made, especially in Scotland, to supply this deficiency.

reasonable suggestion, but until it has been carried out we have to be content with the existing accommodation. We may in many cases, then, receive these patients with incipient disease into hospital for a time. It generally happens that their condition improves, and that after a certain number of weeks they leave the hospital with the progress of the disease arrested.

After the rest and good food and other treatment in hospital, in which attention to *sanitation and ventilation* must be particularly cared for, it is possible that the patients may be able to change their occupations and to substitute an open-air business for one which is carried on chiefly indoors. If such a change is possible it is highly to be recommended; such occupations as involve prolonged exposure to ill-ventilated atmospheres, cramped positions, exposure to damp and draughts, irregular hours and irregular habits of eating and drinking, especially the latter, should be given up, and others necessitating plenty of open-air work should be substituted. If the patients can quit the town for good and all, so much greater is the chance of recovery.

The question is not unfrequently asked—whether a patient who can just afford to be idle had better be idle and do nothing, or whether he should take up some light occupation if such be offered him? The answer as a rule should be that he should not be idle. A possible exception to this rule exists in the case of those who are subject to frequent attacks of blood-spitting in the course of their illness. In such cases it may become necessary to enjoin idleness, at all events if an attack can be directly traced to over-exertion. We must not forget that it is sometimes possible for the patient to leave his work in this country and emigrate to Australia or America or Southern Africa with the idea of taking up some out-door work

there. To this possibility we shall take occasion to refer again, but we may say here that farming in Australia or California certainly seems to open out great potentialities of a healthy life if the patients are sufficiently strong to endure its initial hardships and possible disappointments.

In carrying out our fundamental indication for treatment, viz., a proper supply of pure air, comes in the necessity of *healthy living and sleeping rooms*—rooms the cubic capacity of which comes up, at any rate, to the very moderate requirements of the model bye-laws of the Local Government Board.[1] The arrangement for free ventilation of all rooms in which the sick live and sleep must also be sufficient. Thus, at any rate, the windows should be capable of easy opening, and, if possible, the *deep-sill* plan should be adopted so that the windows may be kept open day and night without draughts. This free ventilation may appear an heroic method of treatment to be adopted in the case of those invalided by phthisis, who generally are under the impression that the slightest breath of cold air will give them cold and make them very much worse. It is certain, however, that such simple means for the introduction of purer air into the rooms in which they are may be well borne by the majority of patients, and will be found to be highly beneficial. Such precautions are necessary in the case of those who live in good houses and have the advantage of lofty and adequate rooms; it is obvious that they are still more necessary in the case of

[1] These provide a minimum of 300 cubic feet for every person over ten years of age in sleeping rooms and 400 for rooms used by day as well as by night. In modern prisons the cubic space allotted is 800 per person. The same amount is thought sufficient in schools. In hospitals the proportion is higher still, and in some of the newer buildings reaches 1,200 to 2,000 per patient. "Cubic space is of little value in itself unless accompanied by efficient means of ventilation."

those who live in one or two rooms of the smallest dimensions.

In conjunction with this elementary principle of health it is always as well to impress upon the patients the good likely to accrue from remaining for as many hours as they can out of doors wherever they may be. Under favourable conditions it is often possible not only to walk about in the open air for the required exercise, but also to indulge moderately in such outdoor *games* as will help to pass the time pleasantly. This will also tend to bring into play many of the muscles of the body which would otherwise remain unused, will increase the gaseous interchange in the lungs, and will tend to impress upon the organism an increased metabolism of a healthy nature. The value of games and outdoor amusements has always been recognized in such winter health resorts as Davos Platz, in the shape of skating, tobogganing, and the like, whilst in the Riviera, lawn-tennis, riding, rowing or sailing, and so on, may with due precaution be indulged in, to the great benefit of the patient as long as the disease of the lungs has not proceeded far. When called upon to advise a patient with incipient tubercular disease, however, as to the amount and kind of *exercise* that he ought to take, it is, of course, very necessary to have regard to the kind of life that he has been accustomed to lead. The habitually active person, to whatever social class he may belong, must be encouraged to lead a different life to one whose habit has been of the lymphatic type, and by whom active exercise is regarded more as a penalty than as a pleasure. As a rough rule it may be said that sufferers from incipient phthisis should be advised to take regular and steady exercise every day in the open air, provided that such exercise does not produce dyspnœa. This rule excludes at once a certain number of

games, such as cricket, football, athletic sports, and the like, all of which cause their votaries to get more or less "out of breath." The choice of forms of exercise, therefore, is limited at the outset. It becomes still more limited when questions of ways and means have to be seriously considered. The opportunities of playing games or of enjoying out-of-door sports are for the most part denied to those who are not well-to-do. For the young clerks, the shopmen, the printers, and others, who form so large a bulk of the whole number of town-dwelling consumptives, outdoor exercise is very much limited to walking and cycling or rowing. Of the two latter forms of exercise it must be remembered that they are only admissible if they be practised with strict moderation. The cyclist must be content to limit his pace to seven miles an hour at the outside, and should not be allowed to ride for several hours in succession or in a hilly country, and in the same way, rowing must be limited to steady and slow strokes, and no competition should be allowed. Of walking exercise it may be said that so long as the pace is never fast enough to produce shortness of breath, or the distance far enough to cause decided fatigue, the amount of exercise so taken may be left to the discretion of the patient and his doctor. Walking in a hilly country is to be preferred to walking along the flat, if circumstances allow any choice, but again the proviso must be made that the up-hill pace must be kept within the limits of easy respiration.

In the selection of forms of exercise for the well-to-do the choice is a wider and more easy one. Dividing them roughly into winter and summer forms of exercise, the same rules as to moderation apply as in the foregoing remarks. In winter, walking exercise should be regular during the daylight hours, but should not be allowed

after dusk. Skating, when opportunity offers, or tobogganing are excellent and exhilarating forms of exercise if not carried too far. They form a very large proportion of the means of exercise obtainable at the winter mountain health resorts, and are there apt to be greatly overdone if not carefully controlled. Whether in winter or summer it should be impressed upon all incipient consumptives that any sport or game which involves *running* is not good for them. Hence lawn tennis and other similar games cannot be played by such persons without some amount of risk. Rowing in the summer time, seaside hill climbing, or riding are to be encouraged. Perhaps of all outdoor means of exercise the ancient game of golf, which has of late years become so universally popular, presents in the highest degree the requirements looked for by the sufferer from incipient phthisis. It is played in open, breezy places, often amongst hills; it involves steady exercise of all four limbs, and demands for its successful practice the undivided thought and attention of its players. The daylight hours spent entirely out of doors, amid healthy surroundings, coupled with moderate and continuous exercise of all the limbs and complete freedom from introspective worries, provide the consumptive with some at least of the most essential conditions for the arrest of his disease.

It would be idle to pretend, however, that patients can indulge regularly in these amusements. It too often happens that intercurrent catarrhs, attacks of dyspepsia, and the like, interfere and confine them within doors. It would be obviously dangerous to increase the chance of fever and other bad results by allowing patients with commencing consumption, in whom a catarrh has begun, to follow without interruption the outdoor life above pre-

scribed. However, we fully believe that by a careful increase of open air treatment we considerably lessen the number of catarrhs, considered by some to be inseparable from the complaint.

So much of the success in treatment depends upon the intelligent interpretation of the doctor's instructions by the patient, that even walking exercise has been minutely graduated at some health resorts on the Continent, and notably at Arco, in the Austrian Tyrol, where the amount of walking exercise to be taken by each patient per day is accurately marked out by posts of different colours. The exact amount of exercise is thus prescribed daily by the physician with the same precision as obtains in the case of diet or drugs. This form of treatment by graduated walking exercise has been dignified with the name of *Terrain Cur*, and although the glamour of that mysterious title is not very likely to impress especial faith in the mind of the English consumptive, the principle of careful and exact graduation in all forms of treatment is an excellent one, which is far too much neglected in this country.

Whilst, then, strongly urging the necessity of fresh air and out-door exercise, we cannot recommend the indoor exercise of dancing, which is so often part of the evening amusement of the frequenters of winter health resorts. It not infrequently happens that the doctor has actually to add force to persuasion to prevent indulgence of this kind. In this connection it will not be out of place to comment on the importance which Niemeyer attached to dancing as the cause of pulmonary catarrh. He says ("Pulmonary Consumption," New Sydenham Society's Translation, p. 29): "I possess among my reports of cases a number of examples in which excessive dancing, or similar exertions, were immediately followed by the first

signs of a commencing pulmonary consumption." It will be recollected that dancing is nearly always indulged in under conditions not too healthy; the heat, the stuffy atmosphere, and, above all, the dust, cannot be considered an ideal of healthiness, but when to this is added the possibility that the dust contains the sputum of the phthisical, dried and powdered, it is no wonder that dancing is forbidden absolutely by the physicians who practise at such health resorts as Davos.

Such considerations bring us to another important point, namely, the rule that patients in the condition of which we are treating should *go to bed early*. In order to ensure that the practice is properly carried out it is necessary to place the rules as to rising and retiring in the category of "medical instructions," to be followed with the same precision as the rules for diet and medicine.

To summarize briefly, a patient with early phthisis, who is losing flesh, should be required to remain in bed till 9.0 a.m., but to take a glass of milk, with or without whisky or rum (from two to four teaspoonfuls), at about 7.30, especially in the winter months. Rising at 9.0, and breakfasting as soon as dressed, exercise should be taken between 11.0 and 12.30 or 1.0 p.m. The middle day meal should be the most substantial one of the day, and a moderate amount of exercise should be taken again between 3.0 and 4.30 p.m., or later in the summer months, but the patient should not remain out of doors after the sun gets low at any season of the year. The evening meal should not be later than 7.0, and the latest bedtime rigidly fixed at 9.0 p.m. Difficulty may sometimes be met with in obtaining compliance with rules which require so many hours of rest in bed, but the long period of rest is so important that the rules should be enforced as far as possible, and in most cases it will be found that

the habit is easily acquired, even by those who have previously asserted that so much sleep was "impossible."

The Question of Clothing.—There are many minor details of importance in the successful treatment of early phthisis to which the medical adviser must give his attention, apart from the general surroundings and mode of life to which we have already referred. Foremost amongst these comes the question of *clothing*. Roughly, it may be said that consumptive patients are always either too heavily or too lightly clothed. This is especially marked amongst the poorer classes, where over-clothing is a very common error. No sooner has the patient realized the disquieting fact that he is the victim of a "weak chest" than his thoughts turn in the direction of a chest protector, and unless he can be deterred in time, he proceeds to set up the well-known red flannel pad with which he has been made familiar by the public advertisements of the vendors of such wares. Not uncommonly the patient endeavours to improve on the advertised article by constructing one of fur. In due course some such covering becomes a necessity, as a chill is not unnaturally felt when the thing is taken off for a while. Little by little, as the cough gets no better and often the sweating gets worse, more clothing is added to that already worn until at last it reaches a pitch when the patient is fairly borne down by the weight of it, and is yet afraid to leave any part of it off, while he still complains that he feels every chill. This habit of overclothing, although perhaps rarely carried to such an amazing extent, is far too common amongst the educated classes. Hence at the outset of treatment of incipient phthisis the fact should be thoroughly explained to the patient that the disease will neither be cured nor prevented by excess of clothing and that the use of chest protectors by patients under 45

years of age is a radical mistake which leads to increased delicacy and risk of catching cold in the future, while its present effect is purely mental and not physical, leading the wearer into a false sense of security which is far more pernicious in its effects than a true sense of present danger. In rarer instances the opposite error of too little clothing may be met with. It cannot be too clearly recognized that a moderate layer of some wholly woollen material next the skin, varying in thickness with the season of the year or other climatic conditions, is all that is required to be worn under the ordinary articles of clothing for either sex. The free use of wool, and especially lamb's wool, in all the garments worn by the consumptive is advantageous if not absolutely necessary, but in the case of the clothing next the skin, wool should be insisted upon. Except during the height of summer such garments should be worn high in the neck and long in the sleeve and the leg. The much-talked-of system of all-wool clothing known as "Jaeger's system," while it fulfils all the requirements for consumptive patients, is expensive and good, but the materials employed present no remarkable qualities to distinguish them from other forms of all-wool clothing which may be obtained at a lesser outlay. The use of silk underclothing is sometimes brought forward at the dictates of fashion, but it has nothing further to recommend it and is far less pervious than woollen material, and hence by no means so well suited to the consumptive, to whom free transpiration is a necessity. The custom of wearing "pyjamas," which has grown considerably of late years owing to our more intimate acquaintance with travel and with the customs of the East, is one which may safely be commended to consumptive patients, all the year round. Whether pyjamas or ordinary night gowns be worn, they should

always be made of woollen material, varying in thickness with the season of the year, and not of linen. In a very few instances a difficulty presents itself in the shape of cutaneous irritability, which sometimes reaches such a pitch as to produce actual inflammatory action. Usually the skin can be brought to tolerate the constant presence of woollen material, but in the extreme cases it is necessary to modify the rule of "wool next the skin," and to adopt some of the combined materials of wool and silk, or wool and cotton, which can generally be borne without discomfort. In the case of the sufferer from chronic skin affections, too, it may be found necessary to adopt silk underclothing, but this should be avoided if possible, and only allowed if the silk be woven in wide mesh. Finally, it should always be impressed upon consumptive patients, whether at the beginning or at other stages of their disease, that a frequent change of underclothing is desirable, both for day and night wear, and quite irrespective of the material of which such underclothing may be made.

The Question of Diet.—In a subsequent chapter (Chapter XI.) will be found some general rules for guidance, in the dietetic treatment of consumptive patients, and in the present place we shall only stop to consider some of the points in relation to it which immediately concern the very early stages of the disease. Many persons with tubercular disease beginning in their lungs, experience no symptoms which serve to call the attention to the alimentary tract. In the greater number of cases, however, some major or minor disturbance of appetite or digestion is met with and requires to be thoughtfully dealt with if it is to be successfully overcome. Loss of flesh is perhaps, of all symptoms, the one which is common to the greatest number of consumptive patients, but even

rapid wasting is sometimes met with in cases where digestion appears to be perfect. Too often the occurrence of wasting is met with in indiscriminate prescribing of fatty foods and cod-liver oil, and the resulting increment of superficial fat is looked upon as an evidence of success. But something more is required than the temporary production of subcutaneous fat. Every patient in whom we can fairly assume the beginning of a tuberculous process must be carefully watched to ascertain, not only that the right amount and quality of food is taken, but also to guard against the entry of that which is unsuitable to his particular case, in respect of quantity as well as quality. Minor troubles such as undue hunger or thirst, dislike of food after the first few mouthfuls, slight eructations or local pains are often unmentioned by the patient until specifically questioned, and hence the need, in the earlier stages of the disease more than at any other, to ascertain all that can be known as to the presence or absence of any symptoms of disordered digestion. Having ascertained the presence of such symptoms (to some of which we have before alluded, p. 90), we have to find out their cause and if possible remove it, since, as we have already shown, the maintenance of sound nutrition is above all things to be striven for. Morbid sensations referred to the epigastrium are amongst the earliest of these symptoms, and of them a sensation of emptiness at irregular times is one of the most common. A feeling of hunger exists, but it is not a true hunger, and although it may be stayed for a short time by the ingestion of food, it is apt to return again long before that food has had time to become digested or absorbed. Then again the appetite is very apt to be capricious, and likes and dislikes of the most remarkable description are formed.

With these, occasional feelings of nausea are complained of, associated sometimes with a good deal of flatulence. Many of these morbid sensations can at once be traced to obvious errors in diet, and with removal of its cause the symptom is often relieved. Of the morbid craving for food at odd times it may be said that it is a neurotic rather than a gastric phenomenon, and it is therefore by no means wise to allow a patient to give full play to his desires in the matter of such craving, as his habits of regular digestion are thereby disturbed, and in most cases his morbid craving is only temporarily relieved. In such a case the symptom will be as readily relieved by a few ounces of cold water. As a general rule the meals under such circumstances should be given with even more than ordinary regularity. Small in amount, and at intervals of not less than three hours, the meals should be as carefully prescribed to suit the requirements of the individual case as the medicines.

In considering the digestive troubles of incipient phthisis it must be remembered that a change of habit in diet is almost as potent in the treatment of the local derangement as is a change of scene and surroundings in treating the disease as a whole. The first thought, then, should be to effect some decided and radical change in the routine of diet to which the patient may have become habituated. Not only should an alteration be made in the nature of the meals that he takes, but their time also should be varied. The patient who is used to three meals a day should be encouraged to spread his dietary over five meals at least, and sometimes more. In the early stages of phthisis when the first burst of activity of the disease is passing off, patients require to be fed-up, and this can be best effected by limiting the amount of the three principal meals and by insisting on the administration of

milk, with or without a little added alcohol in the morning, extra milk at night, and a supplementary meal of beef-tea with a little farinaceous food between meals in the day time. As the appetite improves and the function of the stomach seems to be restored, the additional meals may be gradually omitted, the patient returning to his ordinary routine of mixed diet. The less a patient is "made an invalid of" at this stage of his disease the better. As a rule, however, the danger lies the other way, and the patient is too apt to believe himself quite well and to disregard advice as to diet, making light at the same time of the attendant discomforts during digestion. The present state of knowledge does not warrant us in laying down hard and fast lines as to what may or may not be eaten by the incipient consumptive. That the diet should be mixed, goes without saying, and fruit, if properly cooked, should not be omitted from the dietary. As a rule it is well to insist on a full proportion of nitrogenous food, and good meat broths or soups should be given if the appetite fails, as it sometimes does, for meat. The main difficulty with sufferers from incipient phthisis, who are not very ill, is to get them to carry out medical suggestions. The likes and dislikes may sometimes be indulged to an extent that would result in semi-starvation if the doctor were not at hand to watch the peculiarities of the case and to substitute one form of food for another.

Stimulants in large quantities are, as a rule, unnecessary in the treatment of the early stages. The patients are for the most part young, and have not become habituated to the use of alcohol as a regular article of diet. The one exception to this may be the use of a small quantity of brandy given in cold milk at bedtime when actual stimulation of the heart is called for, or when night-sweating causes exhaustion. Brandy, or rum and

milk, in the early morning is not often called for until a later period.

Of all drinks, where it can be thoroughly digested, a light bitter ale is the most suitable to the incipient consumptive. The various forms of light German beer, generically known as "lager," may safely be recommended if they be obtained from first-class breweries, but they should be taken only with the midday meal. Milk with soda water should be the principal drink; cocoa made with milk is, perhaps, the best hot beverage, and tea should be limited in quantity, and only taken in the afternoon.

The value of beef-tea as a stimulant must not be overlooked, and it may safely be prescribed for the purpose when any extra fatigue has been incurred. There are numerous preparations of beef extracts at present obtainable, which are very effective as stimulants and can be readily prepared without any elaborate cooking.

Baths.—Consumptive patients in the earlier stages of their disease frequently ask for advice and guidance as to the use of baths, whether in the form of the morning "tub" or in the open air, either in fresh or sea water. In the later stages of the disease they generally decide the question for themselves. In giving such advice it is necessary to remember that one of the most troublesome symptoms to cope with in later periods is the sense of chilliness and the fear of chills, which leads so many patients to avoid cold air and cold water alike, to overclothe themselves, and to wash as little as possible. By the judicious use of baths in the earlier stages this susceptibility to chills may be in a great measure counteracted. The use of the daily "tub" may be safely recommended to those who have become habituated to it, provided that certain precautions are observed. The water

must not be too cold, and should be maintained at a fairly high temperature (about 85 degrees Fahr.) at all seasons of the year. During the colder months it is a wise plan to let the feet be kept warm by standing in a pan of hot water while the body is quickly sponged over with the colder water. The bath should be short and sharp, and thorough drying with a rough towel should follow immediately. If a glowing reaction be produced nothing but good will result from such a bath, but if, as sometimes happens, this reaction does not follow and the extremities incline to be cold and livid after it, the bath should be discontinued or warmer water should be used. Once at least in each week it is advisable that a hot bath should be taken at night and the body thoroughly cleansed with soap. The skin may by these means be kept in health to resist the possible chills to which it may be exposed. Such chills, be it remembered, are not only productive of discomfort and possible catarrhs, but also of very decided derangement of the functions of the liver and other internal organs, which in their turn depress bodily vigour and disturb the processes of healthy nutrition. So important is this training of the skin regarded at many health resorts, especially on the Continent, that regular courses of douches are prescribed for incipient consumptives in the institutions where they can be effectively carried out, and the most satisfactory results are recorded even in cases with tendency to hæmorrhage. These douches are always very short in duration, lasting only from five to 45 seconds, the production of a good reaction being the chief object held in view. The use of the Turkish bath is not, as a rule, to be commended to consumptives, although many sufferers have found great benefit from it in the first years. The skin reaction is brought about very fully at the close of the bath, but the

preliminary stages which lead up to it are sometimes too great a tax upon the powers of patients in whom the wasting process has begun. Bathing and swimming in the sea or in fresh water in the height of summer may be permitted at discretion to the more robust patients, but it is advisable as a broad rule to forbid such bathing to incipient consumptives. The objects to be aimed at in the use of baths are skin-stimulation and skin-cleansing. and these can best be attained by the methods we have indicated.

Drugs in Early Phthisis.—Although attaching far more importance to the general lines of treatment already discussed, than to the value of drugs in the arrest of early phthisis, it is necessary that the advantages to be gained from their use should be considered in turn. Like other methods of treatment, all drugs must be used with due regard to the conditions of each individual patient, and no drug should be indiscriminately prescribed because it has a reputation for "being good for phthisis."

As regards *external applications*, opinions have differed greatly from time to time, but from our own experience we have no hesitation in strongly recommending their use at the outset of the disease, when the lesion at the apex of the lung or elsewhere appears to be limited and of recent origin. Care must be exercised to make sure that the counter-irritant is used over the actual area of disease. Cases not unfrequently occur where the patient complains of pain, and more rarely of tenderness, over an area of the skin remote from the affected region of lung. We have found in practice that this pain is frequently lessened and that the local evidences of disease become less under energetic local counter-irritation. The use of a small blister (*e.g.*, *Emplast Cantharidis*), one inch in diameter, placed over the seat of active and early disease

is sometimes followed by marked relief to cough, a matter to which we shall have further occasion to refer. An interesting series of observations have recently been made by Dr. Henry Head, tending to show that a definite relation exists between visceral disease and certain more or less clearly defined areas of the skin, whereby active visceral disease is accompanied by well-marked tenderness in these areas. In using counter-irritation attention must be paid to the type of skin, whether it be easily irritated and slow to heal or the reverse. In doubtful cases it is best to begin with the simple Tinctura Iodi, and if that be found insufficient, the Linimentum Iodi or still more active measures may be used. A moderate amount of irritation should, however, be maintained for two or three weeks or longer if good results appear to be ensuing.

Next as regards the use of *internal drugs.* We have already pointed out that sound and perfect digestion is, above all other things, to be aimed at in dealing with early phthisis, and this consideration must never be out of mind when making use of drugs. If, then, there be any digestive difficulty, our first effort must be in the direction of setting it right, before any general or special drug treatment is entered upon. Of the regulation of meals we have already spoken, and although this may of itself be sufficient to restore sound digestion, it may require to be supplemented by the use of alkalies or bismuth before meals, or by the addition of a small quantity of papain or pepsin with a little hydrochloric acid after meals.

Much also depends upon the regular action of the bowels. Constipation is the rule rather than the exception at all stages of phthisis, and particularly so at the outset of the disease. It is often necessary to keep up

the use of gentle purgatives for a considerable period, more especially when the patient is from any cause debarred from taking active exercise. The compound liquorice powder (Prussian formula) in doses of from one to two drachms, well-stirred into a tumbler of hot water the last thing at night, or a pill containing Ext. Belladonnæ gr. ½, Ext. Nuc. Vom. gr. i., Pil. Rhei Co. grs. iii., may be taken as types of the quality and strength of purgative most suitable for continued use. Once or twice in every week it may be advisable to give a single dose of blue pill or Calomel, or Podophyllin to keep up the flow of bile:—

℞ Podophyll. Resinæ, gr. ½.
Pil. Hydrarg., gr. i.
Ext. Hyoscyam., gr. ii.

℞ Ext. Euonymi Sic., gr. i.
Podophyll. Resinæ, gr. ¼.
Pil. Rhei. Co., gr. ii.
Ext. Hyoscyam., q. s.

Tonics must next be thought of, and of these the time-honoured prescription of Sulphate of Quinine, in varying doses (gr. i-iii.), thus:—

℞ Quininæ Sulph., gr. i. to iii.
Acid Sulph. dil., ♏v.
Sp. Chloroform, ♏x.
Inf. Aurantii, ℥i.

may be given the foremost place in ordinary uncomplicated cases. The mineral acids and bitter infusions are, as a rule, very well borne by the subjects of early tubercular disease. Liquor Strychniæ in doses of ♏i. to ♏v. may be combined with the foregoing or given with phosphoric acid:—

℞ Acid. Phosph. dil., ♏xv.
Liq. Strychnin., ♏iii.
Sp. Chloroform, ♏xv.
Inf. Quass. ad ℥i.

with advantage, but its use is less requisite in the earlier than in the later stages. Anæmia is sometimes a marked

feature of the beginning of the disease, and iron and arsenic are frequently brought into requisition for its treatment. Iron is not always well borne in this disease, and care must be taken to watch its effects. As a broad rule, the view taken by our late colleague, Dr. Milner Fothergill,[1] is in the main correct, viz., that a high temperature, a furred tongue, and disordered digestion are counter-indications to the use of iron. Even in the presence of some of these conditions, however, we have seen benefit obtained from the use of iron and arsenic in combination, especially in the following formula:—

℞ Ferri et Ammoniæ Citratis, grs. x.
Liquor Arsenicalis, ♏v.
Aq. dest. ad ℥i., t.d.s.

In cases in which there is very marked anæmia, arsenic may be given in association with iron, but not in combination. Thus, five minims or more of the Liquor Arsenicalis may be given after meals, and followed in the course of an hour by a pill containing a grain of Sulphate of Iron and two grains of Carbonate of Potash.

Among tonics, since, as we have seen, loss of flesh is so marked an indication of early phthisis, we may, for the nonce, include Cod-liver Oil. We give details of the drug itself, its method of preparation and administra-

[1] With the following remarks of Dr. Fothergill, in a paper called "When Not to Give Iron," we are fully in accord :—" . . . conditions of vascular excitement are unsuited for the exhibition of iron. As long as there is rapidity of pulse, combined with rise of temperature, so long must iron be withheld in the treatment of acute disease. When the convalescence is well-established, when the pulse may be fast and small, but is without excitement; when the temperature is perfectly normal or below it; when the skin is cool, the face pale, and the tongue clean, then, and not till then, should the administration of iron be commenced . . . as long as the tongue is thickly coated, or red and irritable, it is well to withhold chalybeates altogether."

tion, in a separate section (to which reference may be made), and it is only necessary here to consider its value at the onset of the disease. The common difficulty that is met with at first is that of imperfect digestion. Many patients who are not nauseated by the taste of the oil may yet be troubled by constant eructation for a long time after taking the medicine, and even after another meal is in process of digestion. Under such circumstances endeavours should be made to obtain a purer oil, or the emulsion of oil and maltine may be tried. Others may complain of the taste of the oil but appear to digest it fully. For them it is best to reduce the dose. One teaspoonful instead of the usual dose of two teaspoonfuls may be given twice in the day after the two principal meals. As tolerance is established the dose may be doubled, but in prescribing cod-liver oil for the first time for any patient it is always best to begin with a small dose. It often happens that patients take a permanent dislike to the oil simply because of their efforts to swallow too large a dose at first and before they were accustomed to the oily nature of the substance. If the patient can take the small dose and digest it, cod-liver oil should be made a part of the daily round of the treatment of incipient phthisis.

It should be recollected that palliatives are not, as a rule, much needed in the treatment of consumption in an early stage, as there are, as before mentioned, few symptoms which give trouble. It is this latter fact which so often prevents the detection of the disease until well advanced. Sometimes, however, the cough is troublesome from the very commencement. It is a matter of some difference of opinion as to the character of the cough of early phthisis, but it must be a matter of common experience that it is often very wearying and difficult to alleviate. Some-

times, too, it is as paroxysmal as whooping-cough, and, indeed, closely resembles that affection, being highly spasmodic, and often leading to retching or vomiting; but this is less often the case in the earliest stage. In any case the cough at first is dry and hacking, or accompanied by a small amount of frothy expectoration; it is essentially the cough of irritation, and so should be treated by anodynes. It is not what may be called a conservative cough to remove secretion. We have not that rooted objection to small doses of opium or morphia under these circumstances which some have. We have not the slightest doubt but that the best treatment of the cough in such cases as have definite physical signs, at one apex for example, is a mustard leaf or a small blister about the size of a shilling over the seat of the diseased part; this has frequently relieved a cough even of the most irritating description. It may be repeated from time to time. The quickest form of blister which we have met with is produced by the plaster called "canthos." With this we may expect a blister to rise in about eight hours, instead of twelve or more with the ordinary emplastrum cantharidis of the B.P. Instead of a blister, if less severe counter-irritation is desired, Lin. Iodi, or Lin. Crotonis, the latter applied to a small area, is very efficacious. Some patients, however, strongly object to the latter liniment as causing even more pain than a blister.

We may, unfortunately, have to come to the morphia as a more regular treatment, and if so may make use of one of the following prescriptions (in each the dose of morphia is unobjectionable):—

℞ Liquoris Morphinæ Hydrochlor., ♏iii.
Spiritus Chloroformi, ♏iii.
Glycerini.
Aquæ aa, partes æquales ad drachmam unam.

To be taken three or four times in the twenty-four hours when the cough is most troublesome.

Or (Linctus Acidus) Hare's formula —

℞ Liq. Morph. Acetatis, ʒiii.
Acidi Nitrici dil., ʒss.
Oxymellis Scillæ, ʒvi.
Mucilaginis, ℥ii ss.
Glycerini, ʒii.
Lqr. Rhœados, ʒii.
Aq. Cinnam. (vel rosæ) ad ʒvi.

To take one or two teaspoonfuls, five, six, or seven times in the twenty-four hours.

Another linctus sometimes useful, and at any rate simple, is made by taking boiled milk and glycerine, equal parts, with or without some flavouring agent in addition.

The direct application of a weak solution of Hydrochlorate of Cocaine to the fauces will often serve to check an irritative cough if slight degrees of tonsillitis or of pharyngitis be present. Cocaine lozenges are of very little use under such circumstances. When dissolved in the mouth they produce partial anæsthesia of the tongue and of the roof of the mouth, but their effect seems to be exhausted in so doing, and is never exerted upon the pharynx and tonsils at all. Slight acute laryngitis is often a cause of irritative cough. Its treatment will be discussed in the section dealing with the affections of the throat in phthisis.

In addition to tonics, cod-liver oil, and palliatives, an important question has to be considered, viz., the advisability of using some of the so-called specific remedies which have been put forward from time to time with the object of destroying or rendering inert the activity of the tubercular virus. Detailed information upon (*b*) *the*

antiseptic treatment will be found in Chapter X. The method introduced by Prof. Koch of attacking tubercular tissue by means of injections of "tuberculin" into the tissues has been already alluded to. The principle upon which the material was used and prepared appears to us to be based upon the soundest foundation. The use of tuberculin has been given up as a means of ordinary treatment for the simple reason that suspicion attaches to it, that, while destroying and causing disintegration of existing tubercular lesions, it may sometimes give rise to fresh lesions in organs hitherto unaffected, and may thus leave the patient in worse condition than before. It is more than probable, however, that the method, with improved modifications, will be some day generally adopted, since it is practically the only one which gives any hope of the actual cure of the disease, though many may assist in its temporary arrest. Prof. Klebs has recently introduced a modified tuberculin, which he calls "tuberculocidin," a material he obtains from tuberculin by purification. He has published a series of cases, in which the new substance has appeared to destroy the activity of the tubercular process without risk of extending that process in other parts of the body. If further experience of this method in the hands of others supports Klebs' contention, there is no doubt that considerable progress in the treatment of the early stages of phthisis will have been made. At present, and until further opportunity for observation has been afforded, we must hesitate to recommend its use.

Creasote must now be ranked next in the order of special drugs. The attention of the profession has been drawn to its use every now and then for many years, and in another section it will be seen that it was considered of special value at the beginning of this century. The

main objection at first found to attend its use was the smallness of the dose patients were able to take without great disturbances of digestion. Drop doses only, given in the form of pil creasoti or in gelatin capsules, increased to two drops, were found to be as much as the stomach could stand. Whether the drug now in use is purer than that obtainable formerly we do not know, but it is an undoubted fact that patients are now able to take much larger amounts of the drug. We often give it in the form of a mixture as follows :—

℞. Creasoti, ♏iii-x.
Sp. Chloroform, ♏x-xv.
Ex. Glycyrrthizæ Liq., ℥i.
Inf. Gent. Co. ad ℥i.

By this method patients are able to take half-a-drachm or even, in some cases, a drachm in the course of the twenty-four hours, and, moreover, without either nausea or other disturbance of the digestive functions. In this way it is seen that the former objection to the administration of the drug is reduced to a minimum. Of course cases do arise every now and then in which a tolerance of the drug cannot be set up.

The exact value of this drug in the cure of phthisis is not known, and further experience is wanted before any dogmatic statement can be made upon the subject. We propose to make further observations upon it in another section.

Creasote may also be prescribed in cod-liver oil (minims v. in Ol. Morrh., drachms two) twice or three times a day.

Guaiacol, one or more of the essential principles of creasote, has been much recommended as a substitute for that drug. It is not so pungent or (to some) so disagreeable, and may be easily tolerated. We have made use of

it in five-minim doses to a considerable extent, chiefly dissolved in Ol. Morrh.

Carbonate of guaiacol has been much advocated instead of creasote or guaiacol itself, and equally satisfactory results have been obtained by its means.

Combined with the exhibition of creasote by the mouth, inhalations of the drug may be employed.

In concluding this section, we would lay stress upon the axiom that the use of special drugs and other special modes of treatment in early phthisis must always be subservient to the rules of general and personal hygiene already laid down, and if these special methods of treatment appear to disturb digestion, produce loss of appetite, loss of sleep, or other untoward symptom, their employment must be promptly relinquished.

And one word more of caution. Immediate results of treatment by the so-called anti-bacillary treatment must not be looked for or expected. The improvement which takes place when it does take place is essentially gradual, and hence treatment, whatever it may be, should be steadily persevered in for weeks, or even months, without intermission. It is no doubt owing to this greater perseverance that a larger proportion of good results are obtained in medical treatment in those countries where faith in medical treatment and the value of remedies is greater than in our own.

CHAPTER VI.

ON THE ACTIVE AND PROGRESSIVE DISEASE AND ITS TREATMENT.

When Arrest of Pulmonary Tuberculosis is most likely to Occur.—As might very naturally be supposed, arrest of the tubercular process in the lung is more likely to take place in an early than in a later stage. We have learned this from the records of post-mortem examinations of persons who have died of disease other than tuberculosis. These records, as we have seen in an earlier chapter, tell us that remains of healed tubercle may be found in a considerable proportion of the cases examined, but these remains are, generally speaking, of tubercle localized to small districts of the lung. It is much more uncommon to find the record of cases of more extensive tuberculosis of the lung which have been cured, leaving behind only cicatrices. It necessarily follows that the disease as it progresses, obtaining more and more force from its own impetus, must resist more and more the healing process, and that the treatment becomes more and more difficult and less and less hopeful. Indeed, when the affection has spread to large districts of the lung tissue beyond the primary focus, we find that our treatment at last resolves itself into a mere treatment of symptoms.

The Period when Early Phthisis may be supposed to pass into the Active and Progressive Disease.—We are unable to put any distinct limit to the period in its history when pulmonary tuberculosis passes from a con-

dition in which cure may be reasonably expected, into one in which such a hope may be no longer indulged, neither is there any definite line which divides the so-called early phthisis, about which we spoke in the last chapter, and the stage of the active and progressive disease, of which we propose to speak now. For the sake of convenience, however, we may consider the disease to be still in an early stage as long as it has not far advanced beyond the locality in which the tubercle was first deposited, and remains a single lesion. The inclusion of all cases in which the lesion is single may be thought too wide, since for a considerable time the disease spreads by continuity alone, and attacks lobule by lobule, so that a lesion even if single may be of considerable size. With regard to the prognosis, however, it is still in a condition which is eminently curable. We may further consider a single tubercular lesion as early phthisis even although in part it has undergone the retrogressive changes said to be characteristic of tubercle. In fact a fairly extensive lesion almost perforce becomes caseous, and then softens in the oldest part, unless indeed arrest is taking place exceptionally early. As a result of the softening we may expect excavation to follow. These changes do not, however, of necessity imply that the disease is actively progressing. A single district of the pulmonary tissue studded with small cavities, is still compatible with the early stage, and is one from which perfect recovery may result. It is, however, unusual for a single lesion to become very extensive, and speaking generally if we have extensive signs of disease in any part of the lung we probably have to do with more than a single lesion. Whether this is always true or not, a period is reached in the history of the tubercular infection when the lesion (unless the disease is arrested) no longer re-

mains single, and in the actively progressive disease deposits of tubercle take place in other districts, but not always in the neighbourhood of the original lesion. Attempts have been made, to which we have alluded in Chapter III., to show that the deposits of tubercle may be expected to take place in some fairly definite order. It is then a matter of considerable convenience if we look upon pulmonary tuberculosis as having entered upon its second stage when we have distinct proof by physical examination of the chest of the existence of more than one lesion. We know that as soon as this is the case the disease becomes much more complex and difficult to treat, and that the prognosis, as we have before said, becomes much more unfavourable. It is quite possible that in some cases the lesion from its commencement is not a single one, the tissues having succumbed to the attacks of the bacilli in several places simultaneously, but this is a rare occurrence, and naturally a serious one. It is also true that the rate of progress varies enormously in different cases; at one time signs indicating the presence of more than one lesion will appear in a few weeks, in another possibly not in the same number of months. This, as we have explained in a former chapter, is probably due either to the greater resistance potential of the tissues in the latter case, or to a large and widely scattered dose of the poison. Again, it must not be thought that a case beginning acutely and extending rapidly at the first onset need of necessity maintain this rate of progress throughout the whole course. On the contrary such a commencement may very likely be followed by a very chronic after course. The reverse is also true, a chronic case may at any time take on an acute character.

In the course of the apparently active and progressive acute stages it is frequently found, too, that the patient

improves for a time in general condition without any corresponding improvement in the physical signs. The countenance becomes more placid and the spirits more cheerful, while the appetite and other symptoms also seem favourable, and yet the cough continues, the sputum becomes even more copious and more purulent, and the physical signs indicate extension of the local disease and further disintegration of the lung. That such conditions are not inconsistent is evident when we come to consider the nature of the morbid process which is going on. The actual breaking down of tubercular tissue and of the lung tissue surrounding it is essentially a passive process and not an active one. The disintegrating tissue has long since ceased to perform any oxygenating function, and the poison engendered by the original formation of the tubercle is no longer active. Thus the loss of the damaged tissue causes no appreciable loss to the patient. For all purposes of respiration the part has been lost already, while the continued presence of the tubercular material only acts as an irritant to the parts in which it lies, much in the same way as a sequestrum of dead bone will cause continued local irritation till it is removed.

Unluckily it has never yet been found possible to remove disintegrating tubercle from the lung satisfactorily by surgical means, and hence the natural process of softening and evacuation must be patiently endured, with all its attendant risks.

These risks are various and largely dependent upon the condition of the passages along which the disintegrating tubercular tissues have to pass, and also upon the more or less accidental presence within them of certain of the active pyogenic micro-organisms. The patient may thus suffer from the results of a secondary infection, which may be more or less virulent according to the constituents

of the material which is absorbed. The course of the temperature will generally indicate the relative virulence, but if the day temperature be continuously normal or subnormal, the patient will generally be found to improve in condition, although the process of disintegration and evacuation will, as already stated, lead to a decided increase in the local physical signs. Added to this, it may often be found that the sputum is loaded with well-developed tubercle bacilli, sometimes occurring in clustered colonies. Hence arises the fallacy of attempting to gauge the activity of the tubercular process by the presence or absence of bacilli in the sputa. Bacilli are most abundantly found where disintegration of tubercular deposit is going on—a natural process of evacuation of morbid material, which, as we have shown, is often attended with benefit to the patient, and which if it could be complete would lead to cure.

Bacilli, on the other hand, are sometimes only to be discovered by the most careful search in sputum ejected by patients in whom an acutely advancing tubercular process may be present. Hence, for all practical purposes of diagnosis and prognosis, the presence or absence of bacilli must be considered strictly in relation to the symptoms and other physical signs present in each case and must not be held to give either positive or negative evidence when considered apart from the conditions under which they appear.

The Symptoms of the Established Disease.—The symptoms of the established disease in the lung are to a considerable extent the same as those of the early disease, but they are more developed. Thus we have *cough*, but the cough is now much more severe, and is no longer an occasional, but a constant trouble. It is particularly apt to be increased on exertion; frequently, too, on taking

food, or on talking, or on deep inspiration; often worse at night, preventing rest; sometimes coming on in paroxysms and terminating in retching, or even in vomiting. The cough is accompanied by the expectoration of increasing quantities of *thick muco-purulent sputum*, and the sputum on microscopical examination may be found to contain large numbers of tubercle bacilli, and very possibly shreds of elastic tissue. The quantity and character of the sputum vary no doubt with the extent of the disease in the lung, but very soon may amount in the twenty-four hours to several ounces. It may assume a thick greenish yellow colour, and is generally airless to a large extent. The test which used to be employed to indicate the presence of a vomica in the tissue, viz., to notice whether the sputum sinks or swims in water, cannot be absolutely relied upon, but we may receive some aid in the diagnosis of extensive disorganization if the major part of the sputum sinks in the water in the vessel into which it is received. The sputum, strangely enough, is seldom offensive in odour, although this may sometimes be the case, but it has a peculiar smell of its own, which to a well practised nose is almost characteristic. The same smell is sometimes plainly perceptible in the breath of the phthisical.

The *wasting*, which, as we saw in the last chapter, is such an important indication in the early stage of the disease, as a rule continues, and the patient gets thinner and thinner; the adipose tissue disappears from all parts of the body. Thus the face becomes thin and pinched, with the temporal fossæ very manifest, the nose thin and pointed, the arms lean, so that the skin and subcutaneous tissue can be raised in large folds. The bony prominences are everywhere in evidence, particularly of the chest and neck, whilst the spinal prominences of the vertebræ

behind, the spines of the ilia, and all the bony projections of the upper and lower extremities seem almost immediately beneath the skin. The muscular system evidently wastes to a serious extent, and the muscular fibres of the muscles everywhere, and particularly over the upper parts of the chest, show the phenomenon of what is known as *myoidema*, on percussion the fibres rising into great wheals by the contraction of the irritable muscular fasciculi. Even without the direct stimulus of pinching or striking the muscles often exhibit a flickering due to fibrillar or even fascicular contractions. It thus comes to pass that a consumptive in this stage is found to have lost many pounds of weight in a few months. It is common enough for one or two stones of body weight to disappear. We are now speaking of those cases in which there has been no attempt at treatment, and not of other cases. As a matter of fact, it is nearly always possible by suitable dieting and other means of treatment to reduce this wasting to a minimum, but it is the great characteristic of the uncontrolled disease. With the increase of cough and wasting another symptom becomes very prominent in a great many cases, that is, *fever*. A regular increase of the temperature by day, followed by a rise of two, three, or even four degrees at night, is sufficiently common. There are various types of this fever, to which we shall have occasion to refer in more detail in a later chapter (IX.), but the symptom itself is never absent for any length of time. It is almost a criterion of the severity of the disease, since, speaking generally, the more the fever the worse the case. We seldom have accounts of actual rigors, or even minor shiverings, but they occasionally occur. Another, and, as we have before indicated in the last chapter, a distressing symptom, is the night or sleep sweating.

Although *night or sleep sweating* is common enough in the earliest stage of phthisis, it is still more so when the disease has advanced in the lungs. When it occurs it may be confined to one side of the body, to the extremities or trunk, to the head and neck, or it may be general throughout the body. Again, the sweating may be occasional, or it may be constant, but it is always a very serious symptom, and needs careful treatment. We must not forget that when the disease of the lung is advancing, if, indeed, not before, there is often *pain* somewhere in the chest. It is frequently caused by intercurrent attacks of pleurisy, but it is often connected, so it is said, with the actual lung affection (*v.* p. 179).

Hæmoptysis is present in a considerable proportion of cases. This may be severe or slight. In some cases throughout the whole course of the affection a slight spitting of blood occurs every now and then, but when produced by active extension of the disease it is generally accompanied by other acute symptoms. Perhaps the most manifest alteration in the patient after the wasting is the evident *breathlessness* observable on the slightest exertion. This is particularly the case when the patient endeavours to walk up hill or in the house upstairs. Sometimes there is more or less panting on the effort to talk or eat.

The Increase of Physical Signs.—It is unnecessary to deal at any length with the physical signs of advancing phthisis. First of all the signs are not localized to one situation, and secondly they become much more marked as time goes on. We may only mention those that are the most universal : The impairment of the movement of more or less of the chest wall on inspiration, often accompanied by flattening, particularly over the sites of vomicæ in the lungs. Increased vocal fremitus and dulness over the diseased areas on percussion, with bronchial or cavernous

breathing, altering greatly in pitch according to the size and situation of the vomica. Together with these signs there are always râles of different kind, large bubbling or metallic râles in the case of the softening of large areas, or when the cavity secretes a considerable amount of fluid. The vocal resonance is nearly always increased. Over a cavity there is, too, not unfrequently a *bruit de pot fêlé.* All of these signs, however, are carefully treated of and at length in text books, so that it is unnecessary to do more than barely mention them here.

The main difference in the treatment of the active disease.—There is, of course, no absolute line of demarcation between the treatment of what is called, for the sake of convenience, the early stage of consumption, and the next stage, which we have called in this chapter the stage of the progressive disease. We must, however, recollect that as the disease progresses we have to do more and more with the symptoms of fever. The extent of these symptoms naturally varies in different cases, and in all cases appears to be subject to periods of diminution and accession, but as a broad rule it may be taken as an established fact that the higher the day temperature the more active the tubercular disease. There is no doubt that febrile activity is the main difference which separates the progressive from the early disease, and again from the quiescent disease. The treatment in this condition of necessity resolves itself into the treatment of the febrile state, and the treatment of the intervals in which the fever abates.

Treatment during fever.[1]—During the continuance of fever authorities are pretty well agreed that the patient must be looked upon as the subject of an acute disease, just as though he were suffering from acute pneumonia,

[1] *i.e.*, when the temperature never falls below 100° F.

and not tuberculosis. Under such circumstances he must be confined to one room, and for the greater part of the day, if, indeed, not the whole day, to his bed. As an *ideal living and sleeping room* under such circumstances we would choose one that was large, lofty, light, and fitted with large windows with deep sills, allowing of being opened without draught. It should face the south or south-west. It should be painted of a cheerful colour. There should be a large open fireplace in it, and the floor should be polished and supplied with rugs which can be easily cleaned. The temperature should be kept constantly about 63° F., by means of fires if necessary. The windows should be always a little open, and, if the temperature of the outside atmosphere permit of it, should be opened wide. The *bedstead* should be of brass or iron, so as to be capable of easy cleansing and disinfection. It should be provided with a spring mattress. The mattress of wool or hair should be enclosed in an extra covering of stout "tick" or mattress linen which can be easily replaced by another whilst it is being washed. The *bed-clothes* should be warm, and as light as possible. All of the sheets and blankets should be changed much more frequently than in the case of healthy persons. The bedstead should be capable of easy removal from one part of the room to another, in order to give variety to the patient, and to enable him to look through the window. By the side of the bed there should be a small table upon which should be placed a suitable vessel into which to spit. This should be half full of water or of a disinfectant solution, such as carbolic acid (1 in 20) or perchloride of mercury (1 in 1,000). As regards tonics, the patient may continue to take cod-liver oil, etc.

Amusement and Occupation.—As the patient in a considerable number of instances does not feel so ill as to justify, in his opinion, confinement to bed, he will in all

probability find the time tedious and wearisome, so that he may be permitted, if he is able to do so, to read light literature, such as newspapers, magazines, and the like, novels of an amusing type and so on; but he should not be allowed to undertake any hard reading or writing, since, as has so often been pointed out, not only the body but also the mind requires to be rested. When he is tired of reading or sketching, he may be read to and often under such conditions may sleep, which if it is not found to diminish his night's rest should be encouraged rather than the reverse. Nurses "with ideas" may often suggest means of occupation and interest to those perforce confined to bed, and such simple means as learning to knit has been found among patients in hospital to be the slight occupation needed in such cases. However, a wide field for the ingenuity of the nurse is open here!

Diet.—As regards diet[1] great care must be taken to provide the patient with light food, containing as much proteid as possible, well cooked and easy of digestion, and, since the chief part of the day is spent in bed, the food should be chiefly liquid. Thus soups, mutton or chicken broth, or beef tea should form a considerable part of the nitrogenous diet, and milk given either undilute or mixed with soda water, or in the forms of light custards or milk puddings. It is, however, admissible to allow patients even when in bed the chief part of the day a certain proportion of meat; mutton is, of course, more digestible than beef, but the appetite of consumptive patients is so capricious that if they are to be fed upon meat in part a change of meat is almost absolutely necessary, and one finds by experience that phthisical patients who cannot or will not take mutton day after day will take meat regularly, and with benefit, if one day they have mutton,

[1] More details as to food and feeding will be found in Chapter XI.

the next, beef, the next, chicken, and so on. As regards fish, the same remark applies; the patients will take fish occasionally, and enjoy it, but altogether refuse to eat fish day after day for their dinner. The very capriciousness of the appetite in phthisis, quite apart from the question of digestion, makes the dieting of patients suffering from the disease very difficult, and when one considers the duration of some cases, how some patients remain almost stationary in a certain condition of the disease for years, it will be evident that it is indeed a serious question. We may fill up gaps in our diet scale of patients confined to bed in this stage of phthisis by the administration of what is sometimes called by cooks and others "nutritious" beef-tea, that is beef-tea in which a certain amount of ground rice has been well stirred in after boiling, or broth with tapioca and the like. Although their action is probably more stimulant than nutritive, either Liebig's extract of meat, or one of the well-known preparations containing proteid material, such as Bovril, may be given to vary the diet. In certain cases patients will take Valentine's meat juice when they will take nothing else of the kind, so that in spite of its expense and the small amount of proteid it is said to contain, its use in some cases is to be advised.

The employment of alcoholic *stimulants* in some form or another is in the great majority of cases very valuable. As has been found in other specific fevers, the amount of stimulant required, when a febrile temperature is maintained by day as well as by night, may amount to many ounces of brandy or its equivalent daily. In ordinary cases four ounces of brandy or whisky, or four ounces of wine, such as port, sherry, or Madeira, may be given, or lighter wines, such as Burgundy or Rhine wine, in somewhat larger quantity. Many patients like

and even prefer malt liquor; for them stout or good ale may take the place of part of the wine or spirit. We must not forget that some, especially women patients, much dislike the taste of the stimulants mentioned; to them champagne or a liqueur may be not so distasteful. No objection can be made to the use of coffee and tea in moderation. A morning cup of tea with plenty of sugar, milk, or cream, or with, perhaps, *un petit verre de cognac*, will often be found of great use after the weariness of a bad night.

Drugs.—So far we have made no mention of any specific treatment of the *fever* itself. This is simply because it will be found that our greatest resource to obviate it rests rather in good feeding than in drugs, unless, indeed, we may consider alcohol as belonging to the latter category. The administration of Quinine either in continued small doses of from gr. iii. to gr. v. t. d. s. in a mixture like the following:—

℞. Quininæ Sulph., gr. v.
Acid. Sulph. dil., ♏x.
Infus. Aurant., ℥i.
t. d. s.

or in large isolated doses such as gr. x-xx. once in the day,

may be tried; or Salicylate of Sodium in doses, grs. x-xx., Salicylate of Quinine, gr. x-xx., or Salicin, gr. v-xx., will sometimes lower the temperature a degree or so, but it is a fact that few if any drugs can be relied upon to reduce the temperature for any length of time in this stage of the disease. This remark applies also to the comparatively new drugs such as Antipyrin, Antifebrin, and Phenacetin, although in some cases they have been used with a certain amount of success. It is now not disputed that a considerable part of the fever, in most cases, proceeds from the absorption of septic by-products, whether of the ordinary septic microbes only, or of the specific

tubercle bacilli also, is uncertain. As one means by which it appears possible to diminish the septic changes which usually occur in the diseased area, particularly if extensive, is the instillation of the various volatile drugs which have been already mentioned. It is therefore advisable to make a patient use of the oro-nasal respirator several times a day, and also on lying down to sleep at night. Many of these drugs are of use, but we have found the instillation containing Iodoform (*v.* p. 340) the most efficacious for the purpose we have before us. Naturally the freer the elimination of the purulent material from the diseased district in the lung, the less likelihood there is of septic infection, and one of our objects to bring this about is to encourage the due expectoration and not to stop the cough unless it becomes very troublesome and likely to overdo its part; thus the morning cough, after a good night's rest, is really conservative and should not be stopped; it serves to get rid of the secretion which has accumulated during the resting period. If the *cough* becomes very troublesome in the day-time or during the night, it requires treatment, as in many instances its persistence appears to greatly retard the patient's improvement. The cough mixtures already mentioned in the last chapter may be employed, but for a cough which does not give way to these, there is nothing better, as we there mentioned, than a series of small blisters over the area of the most active disease, especially if the disease appears to be superficial and implicating the pleura. Linseed meal poultices to the chest, with a small quantity of mustard, are of use in the same direction, or the painting the chest with a strong solution of iodine, the Linimentum Iodi is the best. The instillation[1] of the various drugs already enumerated, however, or the simple inhalation of steam or carbolic

[1] The formulæ of the instillations and inhalations are given p. 340.

acid, benzoin, or of any of the oils such as oil of eucalyptus in hot water, serves the double purpose of causing a freer expectoration of phlegm, and also of diminishing cough. The pill of the B.P., *pil. ipecac. c scilla* gr. v., two or three times a day, or the following:—R. Morph. Hydrochlor., gr. $\frac{1}{6}$, Pulv. Ipecac., gr. i., Extr. Hyoscyami., gr. iii., every night, is frequently followed by great improvement.

As to the *night or sleep sweats*, although no doubt not immediately dependent upon the temperature, yet they are usually most frequent where fever is most marked, and it may be that the remedies applied to stay the fever may result in their disappearance too, but this is not always the case, and we have very often to treat the sweats themselves. Sponging the surface of the body with tepid water, or with vinegar and water, so grateful in fever, usually diminishes and sometimes stops these sweats, and is especially useful in cases of excessive axillary sweating.

We have at hand, however, many remedies which have a specific action in checking night sweating. The drugs most commonly employed are preparations of belladonna, either the Extractum Belladonnæ, gr. $\frac{1}{2}$ in formâ pilulæ, or Atropine, gr. $\frac{1}{75}$ to $\frac{1}{50}$, in formâ pil., Picrotoxin, gr. $\frac{1}{60}$-$\frac{1}{30}$, Agaricin (from Agaricus Albus), gr. $\frac{1}{50}$ to $\frac{1}{10}$, given six hours before bedtime, or Atropine and Agaricin together. When all of these drugs are found to fail in turn to check the sweating, half a drachm doses of Aromatic Sulphuric Acid in half an ounce of water will often answer, or a pill containing Oxide (gr. v.), or Sulphate of Zinc, gr. ii-v., or both combined. A strange peculiarity of night sweating is that no drug appears to retain for long its power over this symptom. Each perhaps in turn stops the sweating for a time, but only for a time.

It must not be forgotten that patients in the condition

we are considering not infrequently have intercurrent attacks of *blood-spitting*, and although we propose to consider this important symptom in detail in another chapter, we may say here that when these attacks come on the patient should be required to remain absolutely quiet in bed as long as they last, should be fed upon liquid food which should be cold or only tepid, should suck ice constantly, and be briskly purged, especially with calomel. Subcutaneous Injections of Morphia (gr. $\frac{1}{12}$-$\frac{1}{6}$) should be given every six hours. If no effect is produced by such treatment, the patient should have an injection well into the muscular tissue of freshly prepared Ergotin, gr. iii. Of this drug, the purity and activity of which are so important, it seems that there are many almost inoperative kinds, and even the best of them is apt to lose strength by keeping. Of other drugs which have a certain amount of reputation in stopping hæmoptysis, acetate of lead, gr. v. in formâ pill; Tinct. Hamamelis, ♏x-ʒi.; and Turpentine, ♏x-xxx., administered in yolk of egg or other viscid menstruum, appear to be most useful.

Whilst, then, in the treatment of the various symptoms which arise or may arise in this condition of pulmonary consumption we have to employ drugs on occasion, it must be our constant endeavour to do with as few such medicaments as possible. Our mainstay is, no doubt, the careful regulation of the diet and the employment of as much fresh air as we can introduce into the room with safety.

Treatment when the Fever Diminishes.—As time goes on we often find that the treatment seems to catch up the disease, the fever gradually diminishes, the sweating becomes slighter, and the cough less troublesome. With these signs of improvement there is also a cheering increase in the patient's weight, which should be taken

at least once a week and carefully recorded. When once the increase of weight commences, if it be accompanied by an amelioration of the other symptoms, we may hope that the acuteness of the disease is over, at any rate for a time. By degrees, therefore, the patient may be allowed to get up for a longer and longer period daily. This privilege, however, must be carefully watched and guarded, lest by some over anxiety to improve more rapidly than the disease permit, the patient transgresses the rules of prudence, over-exerts himself, exposes himself to cold or the like, and convalescence is interrupted by another attack of fever. It is highly desirable that as soon as the medical man thinks it safe the patient shall, if the weather permit, be allowed into the open air. Indeed, many believe so strongly in this treatment that they move the patient into the garden or upon a balcony of the house in which he lives even before the fever abates. This suggests to us another desideratum for the room in which a phthisical patient should live, viz., that it should be provided with a balcony so that his bed or couch may be wheeled out into the open air, even when it would be undesirable for him to get up and walk out or be carried downstairs. We feel sure that all hospitals for consumption should possess these balconies communicating with the wards. We are inclined to doubt the wisdom, however, of adopting the plan of the open air treatment if the fever is high or if there be much sweating.

Supposing the patient show regular and uninterrupted improvement, which continues for some weeks, rather increasing than the reverse, we may consider him to be for the time in a stationary condition as regards the tubercular disease. In all probability the sputum will have diminished in amount and will be more easy of expectora-

tion, and on microscopic examination the tubercle bacilli will probably be found to be fewer in number. The question almost at once arises as to the future. May the patient resume work? Should he go for a sea voyage or to some health resort for the "*perfect* cure" of his complaint?

The answer to these questions depends very much upon the amount of the lung tissue which has been involved in and damaged by the disease. It should be remembered that intercurrent attacks of fever and extension of the disease may appear at any period in the course of consumption, so that in different cases different amounts of the pulmonary tissue remain sound. It is obvious that the advice must vary with the individual case. We may, however, lay down the general rule that no case should be at once sent far from home directly the defervescence of the fever is complete. Even when only a comparatively small lesion is present, the patient should be kept under careful observation for some weeks before any radical change is advised. In this condition of affairs, *i.e.*, when there is only a comparatively small lesion, the patient may be carefully removed into the country as short a distance from home as it is possible to find the climatic and other advantages necessary in his case. The exact place depends much upon the time of year.

During the *spring* he may be sent to the milder seaside health resorts, such as Hastings, Bournemouth, Sidmouth, Torquay, Falmouth, Penzance, or Tenby. During the *summer* to the coasts of Suffolk, Essex, and North Kent. During the *autumn* to the South Coasts of Kent, Sussex, and Wiltshire, or North Somerset and Devon and Cornwall, or to Nairn in Scotland. During the *winter* months, viz., from November to March, he may try the Isle of

Wight, Torquay, or Bournemouth, or the shores of Cardigan Bay, Aberystwith, or Barmouth.

When the patient has been under observation for a couple of months without an undoubted return of the fever, we may consider the wider question as to his ultimate destination. According to our experience, there are only a comparatively few persons who will be improved by the high altitude treatment in this stage of the disease, unless the lesion is really small, whereas a larger proportion are improved by a stay in such districts as the Southern Riviera, Madeira, and the Canary Islands, that is to say if they are able and willing to leave England and can do so under favourable conditions. It is cruelty to order a patient abroad if he or she has no friend to accompany and render the exile less dreary than it would otherwise be. Supposing the lesion in the lung or lungs is extensive, the patient should not be sent away from England, but should be kept, if possible, in a warm and sheltered locality, and should actually settle down there as his home and be surrounded by all the aspects and companionship of home. A sea voyage, unless undertaken under the most favourable conditions, cannot be advised unless, again, the lesion in the lung is small and there is no indication that the disease is spreading quickly. Even if these conditions be fulfilled, it is doubtful whether a patient is permanently benefited by such treatment. He requires to be a good sailor and fond of the sea to obtain benefit even for a time, and must also be blessed with a good appetite. A great authority on the treatment of consumptive patients told us not long before his death that he had "almost given up" recommending a sea voyage as treatment of the disease as he had "almost come to the conclusion that the disadvantages counterbalanced the advantages." We, how-

ever, consider the question of a sea voyage as treatment elsewhere, and will not delay to say more about it here. For those phthisical patients who have temporarily recovered, at all events, from an attack of fever, and who are unable to retire and live in the country for any length of time, there is nothing better for them to do than to obtain admission into such a hospital or home for consumptives as that which exists at Ventnor—the Royal National Hospital for Consumption. Such cases are those for which this hospital is particularly suited, and, as a rule, are markedly improved therein.

If a patient who has recovered from the feverish attack maintains his weight, or even increases it during some months, particularly if he is relieved from the pressing symptoms which troubled him, *i.e.*, cough, night sweats, and dyspnœa, it may be confidently expected that the disease has entered upon a quiescent or chronic period, even if it is not actually cured. Of the further history of such a case and the pathological cause of his improvement we propose to treat in the next chapter.

Of the Continuously Progressive Disease.—We must, however, say a few words as to the cases which, in spite of careful treatment, do not improve except for a few days at a time, and the tendency of whose disease is downwards. To this class belong cases of general pulmonary tuberculosis, both acute and chronic, in which the lesions are multiple from the first. In some of these cases the treatment never for a day catches up the disease, the progress is uninterruptedly in one direction. The only plan which can be adopted under such circumstances is to try and relieve the pains, the cough, night sweats, and so on, which are so marked a feature of the affection. When the case is not quite so hopeless, when there is from time to time a little, even if slight, improvement, we may

try what careful removal of the patient into the country may do. Sometimes it has a marked effect, and seems for a time to set up the health of patients whose cases before had been considered hopeless. The exact locality to be tried will no doubt vary in different cases.

The cases which do not improve under treatment, however, seldom remain long without exhibiting signs of the tubercular involvement of other parts of the body. For example, symptoms may arise which indicate the beginnings of disease of the throat, the intestines, or the peritoneum, and even in rarer cases of the meninges of the brain. All of these affections must be considered as complications of the primary lung disease, and an account of their treatment will be found in detail in a later chapter (*vide* pp. 162 *et seq.*).

CHAPTER VII.

THE CHRONIC, QUIESCENT, OR CURED DISEASE AND ITS TREATMENT.

The varying damage of the Lung present in Chronic Phthisis.—As tubercular disease of the lung may become arrested at any but the later stages of its progress, it necessarily follows that under the terms chronic or quiescent disease a great variety of conditions must be included in so far as the extent of the lung mischief is concerned. In all these conditions a greater or less amount of lung tissue is permanently and irretrievably damaged, and can never be replaced by respiratory or oxygenating tissue. If only a small area has been affected the interference with the respiratory process is but slight, but where a large one has been rendered functionless, the interference with the normal processes is proportionately greater, and the patient is rendered at all times liable to varying degrees of dyspnœa, and to the many minor troubles to which a deficient power of oxygenation may give rise. The disease, although actually healed, leaves the patient to a greater or less extent permanently damaged. By what means can we ascertain with approximate certainty whether we have to do with the chronic, quiescent, or the cured disease? By the term chronic phthisis, we would imply that condition in which the tubercular disease in the lung, though rarely active, is never suspended. Quiescent phthisis may be regarded as the condition in which the tubercular disease is never

active and is occasionally altogether suspended. Cured phthisis implies the condition in which the tuberculous process has ceased.

Indications distinguishing Chronic, Quiescent, and Cured Cases from those that are Active.—There are several indications by which we may distinguish these conditions from one another. The first is the temperature. The presence of an occasional rise of temperature is almost of itself sufficient to cast doubt upon the complete quiescence of the tubercular disease. It is not enough that there should be no marked rise in the evening, it must also be shown that there is none at any time of the day. It follows, therefore, that the temperature should be taken at least four times in the twenty-four hours, viz., at 8 a.m., 12 noon, 5 p.m., and at 8 p.m. If at all these times there is no appreciable rise above the normal for some months, allowing for the diurnal variations of the bodily temperature, we may have a strong hope that the disease is either cured or quiescent.

The second indication is to be found in the increase or steady maintenance of the body weight, and the absence of sleep-sweatings, defective digestion, and other symptoms of systematic poisoning by the tubercular virus. Cough, depending as it does upon so many conditions apart from actual tubercular disease, may persist for a long time after the disease has become quiescent. Sputum diminishes in quantity, and may even cease entirely, but, like cough and dyspnœa, it gives no true indication of the activity of disease until it has lost its infective power for many months continuously.[1]

[1] *The question whether tubercle bacilli entirely disappear* from the sputum in cases of arrested or cured pulmonary tubercle is a matter of some uncertainty. Some authorities hold that the presence of the bacilli does not by any means prove that the tubercular processes are proceed-

Thirdly, there is also a gradual improvement in the physical signs in the chest. Many of the abnormal signs clear up to a remarkable extent. It is a very rare event, however, for these signs to disappear entirely; the breathing over a scar in the lung tissue is never quite normal. The expiration continues to be somewhat prolonged, and inspiration to be weak, but the adventitious sounds either gradually disappear and finally cease, or remain unaltered in degree, and a considerable part of the impaired resonance clears up. This latter improvement is probably due to the production of emphysema in the neighbourhood of the scar tissue in the lung, which masks to a greater or less extent the dulness on percussion over a solid portion of lung tissue. Over a healed lesion in the lung it is common enough to hear harsh and grating sounds, which are due to the rubbing of a thickened pleura against the chest wall. There are other indications to be derived from the examination of the chest, which are of value in determining this question, such as flattening over the seat of a healed lesion, which is very marked in some cases, and which even amounts to actual contraction of the diseased side and the evidence of pulling up of the diaphragm. To all of these a due amount of attention should be given.

Types of Chronic Phthisis.—In addition to the cases in which, from the diminution of the signs and symptoms of the disease and the absence of fever, we infer that a partial or complete cure has taken place, there are other

ing in the lung tissue, and that, indeed, they may continue in the sputum long after the lesion has become inactive. Our own experience indicates that the presence of the bacilli in sputum is common enough in patients in whom very marked improvement, or even arrest, is taking place, but this does not necessarily imply that the sputum is still infective.

cases in which the actual tubercular disease has ceased, but in which one or more of the symptoms persist. Of the most frequent examples of this class may be noticed those cases in which after the subsidence of the tubercular attack there remain secreting vomicæ in the lung, from which there is daily some, and it may be a considerable amount (several ounces) of expectoration; a pus-secreting membrane having been developed in the cavity or cavities, the pus continues to be formed and spat up. With this pus formation there is naturally some amount of nocturnal fever and its concomitants. The fever and sweating continuing, although, no doubt, to a diminished degree, militate against an increase of weight, which still remains below normal. The wasting is not made up. The physical signs in the chest only very gradually alter, but the disease seems to be pursuing its ordinary course in a downward direction. In such cases much information may be obtained from a careful examination of the temperature chart, which differs in the cases of the secreting cavities from that of the active tubercular disease, a distinction to which we allude on page 318. The progress of the disease, too, in the chest is stopped, so that the original disease is not sufficient to account for the constant, although low fever; in fact, the progress of the disease may be even in the opposite direction, the signs diminishing instead of increasing. We may hope for help, too, in the diagnosis of this condition from the daily examination of the sputum; the tubercle bacilli are not present in such large numbers, and the pus producing micro-organisms are in great excess. In short, we have to do with a condition in which the specific tubercular extension is almost, if not entirely, stopped, but in which there is septic fever and purulent formation; and these keep up the appearance of the disease.

Again, there are other cases in which all the symptoms of the disease have disappeared except the cough, and this continues to be quite as troublesome as when the active tubercular extension was taking place. With the cough there is some scanty expectoration. In the majority of cases this cough seems to us to be due not so much to the "habit of coughing," as has been asserted by some authorities, as to a chronic pharyngeal or laryngeal catarrh which has been developed by the continual coughing in the acute and active tubercular stage, and the irritation of the secreted matters passing through those districts. In some cases, too, it will be found on examination that the tonsils are enlarged.

Many other types of case might easily be brought forward in which patients really cured, as far as regards the disease from which their illness commenced, yet retain some of the symptoms and the general appearance of illness.

There is one other class, however, to which it is necessary to refer—that in which, although the tubercular lesion is cured, the level of the former vitality is never reached. There are no definite symptoms of illness; but the wasting is never made up—indeed, the bodies of such patients are shrivelled up to the smallest possible capacity, the circulation is very slow and small, the hands and feet and the face being nearly always cold and bluish, and the breath is cool. Such patients take the smallest amount of nourishment per diem, and seem to exist rather than to live.

The type is seen in nearly every health resort for consumptives, and is recognized by those who practise in such places. Patients in this condition live on from year to year apparently standing in a wonderful way extremes of heat and cold. On the examination of their chests

evidence of the arrest of the disease in the lung is generally to be obtained. It is a clinical fact of some importance to bear in mind that these patients sometimes die very suddenly. In the post-mortem records of such cases it is frequently noted that the patient was either brought in dead or died shortly after admission to hospital. The little part of the lung still remaining available for respiration having become rapidly choked with the products of congestion or catarrh, the patient had practically been suffocated by morbid changes which would be hardly noticed if occurring in a healthy lung.

Next to the above-mentioned types of case in which actual cure of the tubercular process has been obtained, we come to the cases in which the tubercular disease still extends, and that continuously, but in which the progress is essentially chronic—cases in which the usual progress of the tubercular processes is extremely slow and unattended by those very acute symptoms to which our attention has been directed. It must be recollected that the duration of pulmonary phthisis varies immensely, but the average from its onset to its close is said to be about two-and-a-half to three years. In the cases in which we are treating the duration may be prolonged to ten, fifteen, or twenty years. Yet we never have the proof which we consider necessary that the disease is absolutely quiescent; it is simply chronic, and the patients are never free from cough and a certain amount of expectoration. Every one who has seen out-patients at a chest hospital for many years is familiar with this type—patients who appear year after year, always complaining of something, and who only very gradually get worse. We are not, of course, alluding to the more frequent cases already mentioned which from time to time show periods of complete quiescence, but to those whose disease is never

completely quiescent. Generally speaking, these cases are distinguished pathologically by the presence of a large amount of fibrous tissue in the diseased areas, and it is doubtless this fact which explains the chronicity of the disease. The tubercular material is deposited but slowly, and undergoes less complete caseation. Fibrous change occurs, and thus extension and healing of the tubercular process go forward side by side. The lung area is steadily encroached upon, but the diminution of the oxygenating surface takes place so slowly that its loss is scarcely felt. When the larynx is affected in such cases the slow formation of ulcers, their gradual healing, and the subsequent induration of the parts may be actually seen with the laryngoscope if periodical observations be extended over several months or years.

In any case of arrested or apparently quite cured phthisis we must always bear in mind the unfortunate fact that there is a great tendency to a recrudescence of the tubercular process. This tendency is quite easily to be explained. We have seen that in every case of phthisis there must be either an inherited or acquired susceptibility to the attack of the tubercle bacillus. In any case where the tubercular process is stopped the susceptibility is obviously for the time at all events diminished, so that the micro-organism is no longer able to flourish in the tissues. But the susceptibility thus diminished is not abolished. The periodicity of the disease considered in conjunction with the results obtained by experiments on tubercular animals would lead us to assume that a temporary diminution of susceptibility must be brought about after every period of activity of the tubercular process, and in some cases would even seem to be maintained for considerable periods.

The susceptibility which has been temporarily reduced

may be easily brought back when these favourable conditions are no longer in force, or are even replaced by others specially tending to work in the opposite direction. As far as we know at present, one attack of tubercle does not remove the ultimate susceptibility, but rather increases it. There is no permanent vaccination by the introduction of one crop of the bacilli. There is much to be said for the idea that persons who are tubercular are continually subject to the attacks of fresh doses of the poison, and that many in whom tubercle is actually progressing may be attacked elsewhere than in the primarily diseased area if fresh tubercle bacilli are introduced into the system from outside. This view quite coincides with what we know takes place in cases of phthisis when new lesions occur in the course of the secondary tubercular infection—from inside—by means of the blood or lymph stream.

The Principles of Treatment.—The principles of treatment which must be adopted in the cases of phthisis in which the tubercular processes are arrested or absolutely stopped are sufficiently indicated from what has been said. Such cases must be regarded as at all times susceptible to tubercular infection, and all the precautions which are to be adopted in the prevention of an initial outbreak are to be still more stringently insisted upon. A second tubercular infection finds the subject of it less able to resist the bacillary attack than one attacked for the first time.

Primarily, then, a patient in whom the tubercular disease has been arrested, even in the very earliest condition when the lesion in the lung is small and anatomically unimportant, cannot be allowed to return to the occupation in the midst of which he was attacked. The answer which a conscientious medical adviser should give to the question so often put to him by a recovering

phthisical patient, "When shall I be able to return to my work?" must be "Under the same conditions which surrounded you when you were attacked—never."

As a matter of constant observation a patient cured of phthisis can seldom or never return to his previous work with impunity. What has been already insisted upon, the necessity of an outdoor occupation for the phthisical, or for those predisposed to phthisis, may here be repeated. No sedentary occupation, no exclusively indoor work, none in which the position is of necessity cramped, or in which there is a constant change of temperature of many degrees can be recommended. Plenty of air, sunlight and an equable temperature, without an excess of moisture, are the chief desiderata. If it is unnecessary that the patient shall have any occupation these essentials are much more easily obtained, and a medical man in such a case is able to draw out a scheme of travel and residence by means of which each individual patient may, in the manner best suited to his or her temperament, succeed in finding these season by season. We have entered fully into this question in the section on Climatic Treatment.

It would be unwise here to specify the exact climate to be recommended to a person in the condition we have been considering; no general law exists upon the subject. Each individual case must be considered. The habits, circumstances, and temperament of the patient must be carefully weighed, as well as the actual condition of his lungs. It follows, therefore, that what we have said above is the best advice that we can give, viz., that a scheme should be drawn out for each particular case.

The dieting of patients in a condition of cure must be closely watched to guard against indiscretion. Good and nutritious food in which there is more than a usual amount of nitrogenous material and a considerable pro-

portion of fat, and not so large a proportion of carbohydrate, should be maintained, and the same attention to frequent small meals, regular small doses of alcohol in the form found best to suit the individual case may be advised, following in this, as in other respects, the recommendation we have given elsewhere. Regular and not excessive exercise in the open air during the daylight hours is to be advised. Swimming and sea bathing only for short periods, and under the advice (we might almost say under the eye) of the medical man in each particular case may be indulged in, but no laborious amusement, such as cricket, lawn tennis, or running, should be permitted. Hunting only on the advice of the medical man, and even with his permission only in a very mild form.

Such, then, are the lines upon which a convalescent from tubercular disease of the lung may be treated. The question which follows is naturally, should any medicine be given? This allows of no general answer. Cod-liver oil may nearly always be continued with advantage, and iron in some form or other, such, for example, as in the following prescription:—

℞. Tinct. Ferri Perchlor., ♏x.
Sp. Chloroform, ♏x.
Gycerini, ʒi.
Aq., ℥i.

or in chalybeate natural waters, such as those of Schwalbach, Flitwick, or Harrogate. Such tonics, too, as strychnine, nux vomica, quinine and the mineral acids may also do good. The greatest attention must be paid to catarrhs if they arise, and the patient must be rigidly kept in one room, and, if need be, in bed, whilst they last.

Then, again, any symptoms of indigestion must be

carefully considered, and the condition treated by the means already indicated. The treatment of those patients who are suffering from the purulent secretion of cavities requires to be undertaken with energy. Apart from, and in addition to those recommendations as to climate, dieting, and exercise we have just given, there seems but little doubt that in many cases treatment by antiseptics, by instillation, or by inhalation will be followed by good results. The instillation we strongly recommend as best suited to the case is the Instillatio Iodoformi Co., to which we allude elsewhere.

The respirator, the sponge of which is to be saturated with this fluid, should be used for several hours during the twenty-four, and diligently persevered with. Under this treatment the weight of the patients frequently increases, the sweating diminishes, and the fever, at any rate in a considerable proportion of the cases, gradually subsides. It is also in these cases that we may expect the best results from the administration of creasote in gradually increasing doses (see pp. 122).

As regards the persistent cough, which sometimes remains after the cure of the tubercular affection itself, if it depends, as we have suggested, upon affections of the larynx or pharynx, it naturally follows that attention has to be directed to the cure of these, generally slight, troubles, inhalations of steam, with or without conium, compound tincture of benzoin, or similar preparation, will in many cases be sufficient to remove the cause of the cough, thus :—

℞ Tr. Benzoin Co., f. ʒi. Aquæ Ferventis, Oi. Inhaled from a suitable vessel.	*or*	℞ Olei Eucalypti, ♏xl. Magnesii levis, gr. xx. Aq. Destillatæ, ʒi. ʒi to be placed in Oi. of hot water.

and astringent or demulcent gargles may be tried for the

chronic pharyngeal inflammation. Painting the tonsils with tannic acid and glycerine or with perchloride of iron in different cases also may be required.

As to the cases of chronic phthisis in which the tubercular disease is never active, it seems to us that too little effort is made by physicians to turn them from this condition into a condition of actual cure. We are apt to be content that the progress of the individual case is slow, and we do not take sufficient care to bring about a further improvement which naturally is hopeful, simply because the disease process is not active. Chronic cases of phthisis deserve as much attention as those cases in which the disease is subacute or acute.

As one method which is of great service in bringing about that which we advise, removal to a suitable climate may be mentioned. Next to cases of quite early phthisis, we may expect these old or chronic cases to do best of all in suitable climates. As a matter of fact, however, the sufferers from this chronic form of the disease are, generally, able to work, and hence they remain at home and have little done for them except that they are periodically given tonics and take cod-liver oil. We need not, after what we have already said, do more than insist that such cases be as carefully and systematically treated as if they were acutely ill. If so treated they present most hopeful promise of actual cure.

In dealing with sufferers from chronic phthisis it must always be remembered that the very chronicity of the morbid process renders the patient far more tolerant of the discomforts of the disease than one who is attacked with an acuter form.

The cough, dyspnœa, and occasional rise of temperature which have to be carefully considered and treated in the active stages must in the more chronic be looked upon as

necessary concomitants of the condition. Hence it is seldom wise to attempt the treatment of inevitable symptoms to which the patient has become habituated, but rather to lead him into the way of enduring them with the least possible suffering. The duration of such cases may extend for ten, fifteen, or even twenty years without any activity of the process becoming manifest, but as a general rule the period is far shorter. Accidental circumstances or the indiscretion of the patients are only too apt to lead them into conditions or surroundings in which their dormant susceptibility is reawakened or increased. The process of tuberculization may thus become more or less acute, whether by fresh infection from without, or by reinoculation from within. To guard against the risks which thus beset the consumptive patient who has become well used to his diseased condition, and to mitigate any of the untoward results that exposure to such risks may entail, must be the chief object of treatment. It is in dealing with these cases that the distinction of rich and poor comes into strongest relief. The rich man can afford to keep clear of risks, and has usually his own carelessness alone to blame if by neglect of precaution he has increased the activity of his disease. To the poor man, on the other hand, a certain amount of risk is unavoidable so long as the necessity remains for engaging in remunerative work.

The chief dangers to be guarded against by the sufferer from chronic phthisis are exposure to cold, wet, unhealthy atmosphere and over exertion.

It should be impressed upon all phthisical persons who are still able to engage in regular employment that they should at all costs supply themselves with sound clothing, even though it involve them in expense which they might otherwise shrink from. A good overcoat or

mackintosh may often be the means of averting a chill which would in the long run be a far more costly matter for the patient. In the case of boots this is also of no small importance. From motives of economy patients will sometimes persist in wearing old and leaky boots and thereby incur the risk of wet and cold feet, which may again be the first starting point of a fresh outburst of disease. Not only is it of the greatest importance to guard against such risks of chill as we have mentioned, but it is still further necessary that proper changes of clothing for trunk, limbs, and extremities should always be available, and change should not be neglected if from any cause perspiration has been set up freely during the day, or any damp should have been encountered in the course of the day's work. For all patients with chronic phthisis it is best that a thorough change into warm and dry garments should be made every evening, irrespective of the events of the day, but it is not easy to induce any but the well-to-do to take this precaution. Among the more wealthy, where a change into evening dress is a matter of routine, it is of importance to insist that the underclothing should be of a thoroughly warm description. Ladies especially should be warned of the risks attending the wearing of low-necked dresses. In the progress of chronic phthisis, perhaps more than at any other stage, it is of the highest importance that patients should not permit themselves to remain in close or confined atmospheres. For this reason the smoking room and above all the smoking carriage in trains should be strictly avoided. The inhalation of a smoke-laden atmosphere is more injurious than the inhalation of tobacco smoke from a pipe or cigar, and for patients to whom the privation of smoke is a real drawback no objection need be raised to smoking in the open air,

always provided that the use of mild tobacco be insisted on and the amount of it kept within reasonable limits. Overcrowded rooms, whether during public or private entertainments or meetings, should be avoided, and during the colder months of the year it is advisable that patients should remain indoors after sundown. Over-exertion on the part of sufferers from chronic phthisis generally carries with it a penalty which should not be forgotten. For business men, and especially young men, there is very frequently the temptation to hurry home after the day's work is done, perhaps a sharp run to catch a train or other conveyance, and a consequent increase of dyspnœa, and perhaps sweating, which to a healthy man would be of no importance, but which to the consumptive may contribute in no small degree to the activity of the local disease. The points to which we have thus referred as bringing danger in their train are by no means theoretical or imaginary, but are the summary of actual statements made and often volunteered by patients who have themselves recognized the folly and the evil consequences of the small indiscretions which have led to the increase of their discomforts. No less care and watchfulness is requisite in the matter of diet for the chronic consumptive. Irregularities as to time and quantity of meals are almost sure to exact a penalty sooner or later, and hence all such patients should be earnestly warned to give up the promiscuous indulgence in all kinds of food at irregular hours, which may have apparently done them no harm while still in comparatively good health. Regularity and simplicity should be the warning borne in mind as the golden rule for sound digestion in cases of chronic phthisis. Very often it happens that constipation becomes a real trouble and annoyance. Much may be done to lessen it by careful

variation of the simple dietary and the freer use of vegetable food for a time. The persistent use of small doses of saline purgative natural mineral waters, *e.g.*, Vichy, Æsculap, or the like, on rising in the morning, or the natural salts of Carlsbad (ʒii.) in hot water, need not be feared by consumptive patients at this stage. The idea that too much reliance upon such remedies is apt to create a permanent need for them is not by any means of importance in face of the fact that patients often find that the habit of regular action is restored to the bowels thereby. Sometimes it is necessary to make use of liver stimulants from time to time, if the patient be from any cause debarred from taking regular exercise, but these should be used sparingly and an effort made to induce the patient to alter his mode of living so as to permit if possible of his taking more exercise rather than more physic.

The patient with chronic phthisis who is well enough to work and live an ordinary business life is above all others the most likely to be the means of spreading the disease to others if he be not specially warned as to the necessary precautions in the disposal of sputum. In some cases the amount expectorated is insignificant, but in many others it may amount to a considerable quantity in the course of the twenty-four hours, and it is at all times liable to contain bacilli. Hence it becomes the duty of the medical adviser to give a distinct warning to such patients as to the standing danger that they may be to their fellows if they allow their sputa to be distributed broadcast. The use of pocket flasks is, perhaps, the safest method, but it is difficult to induce patients to adopt it. Failing any such means of isolating the sputa it is best to insist on the use of handkerchiefs made of some cheap material, which can be burnt instead of washed. If this

also is objected to, the soiled handkerchiefs must be kept apart and boiled thoroughly before being sent to the laundry with other soiled linen.

There is not, as a rule, much difficulty found in enforcing rules of precaution in the household, but at the present time it is to be feared that regard for public hygiene is not sufficiently imbued in the public mind, and until stronger measures have been taken to enforce the minor as well as the major precautions, it is probable that the consumptive patient will continue to scatter bacilli broadcast as heretofore.

CHAPTER VIII.

THE COMPLICATIONS OF PHTHISIS AND THEIR TREATMENT.

HITHERTO in considering the treatment of the various phases of phthisis we have chiefly been guided by the clinical phenomena which accompany the onset, course, and progress of the tubercular affection of the lung alone. As a matter of fact, however, we seldom have to do with cases in which the only lesion is the original one in the lung tissue; it is much more common for the tubercular disease of the lung to be, at some period of its course, modified or complicated by some intercurrent affection. Some of these affections are met with so frequently as to be considered almost as part and parcel of the disease itself; of such we may mention as an example the so-called dry pleurisy, the frequent cause of the pains in the chest of the phthisical patient, or the disordered gastric mucous membrane, the equally common cause of the dyspepsia, about which we have spoken in a previous chapter. But besides such frequent complications there are others, not perhaps so frequent, but highly important from the influence they exercise in accelerating or in possibly retarding the progress of the original malady. It is of the highest importance, not only to diagnose these affections, but also to have data at our command upon which to base our estimation of the relative influence which each of them is likely to exercise upon the progress of phthisis for better or worse.

Such data we have sought from the most trustworthy of all possible sources, viz., the dead-house. For the purpose of such investigations the post-mortem records of our own hospital have especially been laid under contribution.[1] We have thus been able to ascertain the relative frequency of the various intercurrent maladies, and to trace the effect of each upon the course of the tubercular affection. It is possible that those who are very conversant with the disease in all its bearings may share with us a certain amount of surprise at the results so obtained.

Classification of the Various Complications.—The complications with which we propose now to deal may, for the sake of convenience, be classified as follows:—

(1.) First, the *thoracic complications.* Of these the most important are pneumonia, tracheal affections, bronchitis, pleuritis, emphysema, atelectasis, glandular affections, cardiac changes, morbid growths and the changes produced by other general diseases upon the thoracic organs. Added to these must be considered the various changes which may take place in the chest walls and in the spinal column.

(2.) Secondly, the *non-thoracic complications*, including the following:—Affections of the brain and its membranes; of the nose, ear, and larynx, tongue, pharynx, and tonsils; of the œsophagus, stomach, intestines, peritoneum, kidneys, and liver; fistula in ano.

Thoracic Complications.—Pneumonia.—Pneumonia may occur in the course of tubercular lung disease either

[1] The post-mortem records of the Victoria Park Hospital, which we have so frequently made use of in the present treatise, not only extend over many years, but have been made, especially during these later years, with the greatest possible care and precision by those who have successively held the appointment of pathologist to the hospital.

in the neighbourhood of the primary affection or elsewhere in the lung of the same or opposite side. It may be lobar or croupous, or lobular, "patchy" or catarrhal.

The latter condition is particularly noticeable when influenza attacks a person affected with phthisis. A distinction should be made between the lobar or lobular consolidation produced by the irritation of the tubercle bacillus in the immediate neighbourhood of the tubercular lesion, which may be, as we have seen in a former chapter, either croupous or catarrhal, and the consolidation of the lung tissue by the introduction of other microbes, either the specific microbe of pneumonia or of the influenza bacillus. The former condition of things must hardly be classed under the head of a complication, whereas the latter is a very definite addition to the tubercular disease, and is to be recognized by definite clinical symptoms, and often by marked physical signs.

Croupous Pneumonia.—Confining our attention first of all to croupous or lobar pneumonia, it should be remembered that it is often ushered in by shiverings and pain in the side, with high temperature, just in the same way as if it were the sole disease from which the patient were suffering. The flushed face, dry harsh skin, the herpes about the mouth are also not seldom present, and, added to this, there is marked increase in the breathlessness, constant short cough—the "ineffective cough" of pneumonia proper—with more or less blood-stained viscid sputum. This sputum, indeed, may almost entirely replace the ordinary tubercular sputum, but it is, perhaps, more often mixed with it. The delirium, or mental "wandering," at night is more common, we think, in pneumonia arising under these conditions than when that affection is uncomplicated. There is seldom the marked crisis which ushers in the recovery from the ordinary pneumonia; the

temperature is more likely to fall by slower degrees. As regards the physical signs, we may, of course, have the usual crackling present, with impaired resonance, passing into dulness, over greater or smaller areas, with increase of the vocal fremitus and resonance, and tubular or bronchial breathing, but the characteristic crackling is seldom present, and the dulness is rarely so widespread and absolute as in the simple cases. It is, however, unwise to draw subtle distinctions, as the symptoms and physical signs may sometimes be almost exactly those of the typical disease, but, on the other hand, there may be but few physical signs to indicate that pneumonia has been added to the original tubercular disease, and between these extremes there are many gradations. It is sufficient to remember that if in a case of phthisis considerable increase of fever arise, accompanied by distinct increase in dyspnœa, careful examination of the chest should be made to confirm or exclude the diagnosis of pneumonia. Delirium is a very suggestive help, as would be also an alteration in the cough and sputum. The sputum should also be examined for the presence of the micro-organisms which are so frequently associated with pneumonia, viz., Friedländer's bacillus "pneumococcus," or the bacillus pneumoniæ "pneumococcus or diplococcus" of A. Fraenkel.

In the cases where the pneumonic process is taking place in continuity with a pre-existent tubercular lesion it is only by careful comparison with the signs as previously observed with those produced under the new conditions that certainty can be arrived at. Hence the importance in the management of a case of phthisis of observing with great care the limits of each area of disease. The onset of pneumonia round such areas is very apt to take place insidiously, and thus a considerable

amount of consolidation may already have taken place before attention is directed to the inflamed spot. The presence of bronchial breathing, or indeed of any increase in the volume or quality of the breath-sound in a given area where only a few days before the sounds were of a decidedly different character, especially if accompanied by increase in vocal resonance and small crepitation, may be taken as evidence of incipient pneumonic consolidation. Great care, however, must be exercised to make sure that these signs are really of fresh development, as many of them may in course of time be equally clearly set up by extension of tubercular infiltration; the main distinction lies in the length of time during which the signs may have developed.

The sudden onset of pleuritic pain, aggravated by the effort of deep respiration added to the other signs and symptoms of commencing pneumonia at the painful spot, would go far to confirm the diagnosis, whether an actual pleuritic rub be heard or not.

The influence which an intercurrent attack of pneumonia may have upon a case of tubercular disease of lung is altogether uncertain. Figures have been published by some observers which would go to show that in some cases recovery may take place rapidly and completely, while in others resolution does not take place at all. In course of time disintegration of the effused products begins, the patient's strength is proportionately undermined, and rapid advance of the tubercular disease follows, often with fatal termination. Prognosis, therefore, must be very guarded, the balance of probability being on the unfavourable side.

Much depends upon the presence within the inflamed areas of non-tubercular specific micro-organisms. Where the more active and virulent types are present the con-

stitutional disturbance and the tendency to disintegration are all the more marked.

For all purposes of *treatment* pneumonic patches must be looked upon as simple inflammatory changes. The patient should be confined strictly to bed, care being taken that the room is well ventilated. The coverings of the bed should only be such as are sufficient for moderate warmth, and consist of blankets and sheet only, without counterpanes or quilts. The diet should be strictly limited to milk, beef-tea, either in the fluid or the jelly form, and a little dry toast or biscuit if there is much furring of the tongue. A small cup of tea (often craved for to allay the thirst which is commonly present) may be allowed twice in the day, but milk diluted and freshened by dashes of soda-water forms by far the best means of relieving this condition. Local applications to the part of the chest corresponding to the inflamed area of lung must be differently used according to the circumstances of the case. When occurring in young adult persons the pneumonic process may be attended with a good deal of local heat and pain. Under such circumstances the application of cold to the part by means of an icebag has occasionally been advocated. That it is effective in such cases in relieving pain and bringing temporary comfort there can be no doubt, but it may also bring about an undesirable lowering of temperature and even collapse, and hence cannot be regarded as a safe means of treatment for general adoption.

In the great majority of cases it will be found more satisfactory to treat the pneumonia by the use of hot moist applications to the chest. A linseed poultice covering a rather larger area than that of the inflamed part of the lung should be applied, and it is well, in the first instance, to put sufficient mustard in it to make the

skin decidedly hyperæmic, and to use simple poultices afterwards. They should be applied for several hours during the day, say from ten in the morning till six at night, and changed as soon as they begin to get cold. It is generally better to suspend the use of poultices at night and to substitute for them a thick layer of cotton wool of the same or a little larger dimensions.

In the cases where physical signs indicate that the pneumonic extension is taking place in a very small area and quite close to a pre-existent tubercular lesion it is sometimes better to use active counter-irritation. The liquor epispasticus, linimentum iodi, or linimentum crotonis may be used for this purpose, and if these should fail to create sufficient irritation a blister should be applied. But this form of local treatment should not be used for any cases where the inflamed patch occurs in a previously healthy tract of lung apart from the phthisical infiltration.

It generally happens that the cases in which these intercurrent attacks of pneumonia are met with are already under treatment by tonic or antiseptic remedies. The use of these may be suspended during the more active period of the attack, but may be resumed as soon as the fresh inflammation appears to be subsiding. During the most active period, when the temperature ranges as high as 103° F. or more, it is better to limit the use of drugs to simple or mercurial purgatives, if the case requires it, and to saline and expectorant remedies. The following may serve as a type:—

℞ Vini Antimonial., ♏xv.
Ammonii Chloridi, gr. x.
Vini Ipecacuanhæ, ♏x.
Syrupus Aurantii, ʒi.
Aquam Camphoræ, ad ℥i.

M.

or Tincture of Digitalis in doses of ♏v-xv. may sometimes be added with advantage, if the pulse be very rapid and weak at the outset.

If there be much depression of strength the use of

alcohol must not be forgotten. Brandy or whisky are, on the whole, the most satisfactory forms in which to administer it, both being miscible with milk and soda-water. The amount to which the patient may have become habituated must be taken into account in deciding what quantity should be used, while the relative strength of the pulse and the degree of restlessness of the patient must be taken as the best indications for increase or decrease as the case progresses. Patients of the phlegmatic type, who habitually lie very still in bed, require less alcohol (*e.g.*, ℥i-℥iii.) than those of the fidgety, excitable type. In the latter class, where the pulse is feeble, and where there is but little alteration of its force or rate after the alcohol has been taken, the stimulant may be pushed to an extent which might be supposed to aggravate the excitement (*e.g.*, to ℥vi-x., or even xii. daily). Its action, on the contrary, in the large majority of cases is to produce a soothing effect, and may often conduce to much-needed sleep.

Sweating during sleep may rarely become a troublesome condition in these cases, but it is not always advisable to check it while active pneumonic processes are taking place. It is by no means an unfavourable symptom during the course of pneumonic exacerbations of phthisis if the depression of strength be not too great, but care should be taken to keep the skin well dried at intervals with warm towels. The steady evaporation which takes place after the actual drops of moisture have been removed aids in the lowering of the temperature, and is less trying to the patient than the burning feeling of feverishness that may sometimes be a source of considerable discomfort. As a general rule, the free action of the skin is a favourable rather than an unfavourable symptom.

Catarrhal pneumonia, although liable to occur in the course of active tubercular disease, is exceedingly difficult

to differentiate from an acute exacerbation of the tubercular process itself. As in the case of simple pneumonic extension, the temperature is generally raised above the normal in the daytime, cough and dyspnœa are rapidly increased, the patient becomes more restless and distressed, and the physical signs indicate, by extension of râles and rhonchi, that a fresh area of lung tissue is affected on one or both sides. There is often a good deal of sweating, but it is not confined to the periods of sleep, being more or less continuous. The sputum is rarely viscid and rusty as in the case of pneumonic consolidation, but is usually increased in quantity. In dealing with this condition, all depressing or so-called febrifuge drugs are to be avoided. It is better to administer stimulant expectorants at first and to use all means to maintain the patient's strength. The action of the bowels should be kept up by the use of saline purges daily, supplemented every second or third night by a dose of calomel (gr. i.), but stronger methods than these should be resorted to if they prove insufficient, and the patient should not be allowed to suffer from constipation.

The diet should be full and nourishing, and alcoholic stimulants should be freely used if the patient's strength appears to be failing. From two to six ounces per diem are often necessary. Any indication of cardiac failure should be met by Digitalis. Quinine in fairly large doses (♏ v-x. three times a day) should also be given, and may occasionally be combined with Strychnia with advantage. As samples of suitable prescriptions for such conditions we may cite the following :—

℞ Ammonii Carb., grs. v.
Vin. Ipecac., ♏x.
Tinct. Chloroform Co., ♏xx.
Glycerini, ʒss.
Aquam ad ℥i.

℞ Tinct. Digital., ♏x.
Tinct. Nuc. Vom., ♏x.
Spirit. Ætheris, ♏xx.
Aquam ad ℥i.

℞ Tinct. Benzoini Co., } aa ♏ xv.
Tinct. Tolutan., }
Mist. Ammoniaci, ℥ss.
Glycerini, ʒi.
Aquam ad ℥i.

The diet should be as full as the patient can digest. Strong beef-tea, milk, meat, jelly, and fish, if the temperature be not above 101°F., should be given at frequent intervals.

If, as sometimes happens, there be much difficulty in obtaining sleep, the following sedative draught may be given:—

℞ Ammonii Bromidi, gr. xv.
Chloral Hydrat., gr. x.
Tinct. Hyoscyam., ʒss.
Aq. Camph. ad ℥i.

Sulphonal in doses of x. to xv. grains will sometimes prove more effective, but it is best to avoid opiates if possible.

Bronchitis and Bronchial Catarrh.—The onset of an attack of phthisis is often attributed to a "common cold" or a "bronchial attack," but in the large majority of cases which come to be closely examined as to the circumstances which have led up to such attacks, there is a strong reason for believing that they are to some extent due to specific morbid changes going on in the lung and not entirely the outcome of exposure to the common causes of catarrh. In the same way, phthisical persons are often said to have taken fresh cold and so added to the severity of their illness, when an extension of the tubercular process is the real cause of the increased symptoms. Be this as it may, it is a matter of everyday experience that the early history of phthisis is often one of recurrent or neglected catarrh, and it is equally obvious that persons with tubercular lesions in their

lungs are prone to fresh catarrhs which affect a much larger area of lung than that occupied by the tubercular lesion. It may be remarked also that the recovery from such intercurrent attacks is often very rapid. Nothing is more common in ordinary hospital practice than for a patient to be admitted suffering from a well-marked, but limited lesion of one upper lobe, and with signs of general bronchial catarrh all over the affected lung and sometimes over the other lung also. After the first twenty-four hours in bed the signs of catarrh entirely disappear, leaving the signs of the permanent lesion just as well-marked as before.

This tendency to recovery, although an undoubted clinical fact, must not be used as an argument to warrant the disregard of "fresh cold" when it arises in the course of phthisis. In some cases, notwithstanding the utmost precaution, tubercular activity appears to be aroused, the temperature rises, not suddenly, but by gradual steps, with steady increase by day as well as by night until it fluctuates between 100° F. and 103° F., never descending to the normal line for several days, and with this the physical signs of extension of mischief may generally be detected. Thus the simple catarrhal attack becomes converted into one of extension of tubercle of varying intensity. In some instances a definite pneumonic process, or a wide-spread bronchitis, may be induced; in others the extension is less active, but none the less progressive, although the advance of the tubercle is more insidious.

It will thus be seen that a fresh cold may be the forerunner of the most serious as well as of the most simple consequences, and hence the necessity for close attention to treatment in the first instance, since it is impossible to say with accuracy to which results any given attack may tend.

No definite rules for universal application can be laid down for the treatment of bronchial catarrh and bronchitis which may complicate phthisis at any of its stages. So much depends upon the stage at which the permanent lesions have arrived, the age of the patient and his previous habits and susceptibilities, that each case must be carefully studied and treated according to the individual indications which it may present.

Treatment of the different types of cases.—We may take first into consideration the class of case where bronchial catarrh occurs as a complication of threatened, early or limited phthisis. Although the catarrh may be in itself set up by the presence of some tubercular infiltration, it should for all purposes of treatment be regarded as inflammatory.

The patient must be confined to the house and as far as possible to one atmosphere, but it is not as a rule either necessary or advisable that the air should be rendered moist by artificial means. The temperature should be maintained at about 60° Fahr. during the cold seasons of the year, and means should be adopted for ensuring a sufficient interchange of air without exposing the patient to cold draughts. Although it is by no means desirable that patients should remain continually in bed under these circumstances it is nevertheless essential that the bedroom and the bed should be so warmed and ventilated that there should be no great contrast between the conditions of the day-room and the night-room as regards warmth and supply of air. It is equally important that no visits should be allowed into cold rooms, and especially into a cold water-closet, but the use of a night stool in the warm room must be insisted on.

Neglect of these simple precautions will often be followed by extension of the catarrhal process in spite of

remedies. The clothing of such a patient must be regulated by the rules already laid down in the consideration of early phthisis. Assuming that the temperature is normal, or only slightly raised above it, the diet may be of the ordinary nourishing kind, the patient's individual peculiarities and his appetite being taken into consideration. As a rule the quantity should be rather more than that for which there is appetite, and it should take the form of extra milk or strong beef-tea at the intervals between the regular meals. Stimulants should be moderately indulged in, but in the case of young people, or those who do not habitually take alcohol, its administration is not as a rule necessary, provided that plenty of food be taken.

Sensations of oppression or tightness across the front of the chest should suggest the use of poultices or stimulating liniments, such as the Lin. Terebinthin Acetic, but as a rule the poultice is by far the most soothing application, and it must be borne well in mind that soothing is precisely the result at which to aim; the actual course of the inflammation is not likely to be much altered by external applications, but the nervous sensations and actual pains to which it gives rise are quite capable of relief by such measures.

Very little is required in the way of drug treatment, but some satisfaction is often to be afforded to the patient by the following combination:—

℞ Vini Antimonialis, ♏xv.
Ammonii Chloridi, gr. x.
Spiritus Chloroformi, ♏x.
Syrupi Aurantii, ♏x.
Aquam Camphoræ, ℥. oz. i.

In the severe cases of catarrh complicating phthisis, it

is always best to keep the patient in bed until the more active symptoms have subsided; the pulse, respiration, and temperature must be the guides by which to be led in deciding this point. A pulse over 85, respirations numbering 26 or more per minute, and a temperature of 100·5° F. in the daytime, may be taken as the limits for treatment by rest in bed. During the first few days such cases must not only be kept at rest, but should be treated upon the general principles which guide the handling of inflammatory affections; the diet must not be too full, and should be limited to fluids. Stimulants as a rule are not advisable at this stage. At the onset of a severe catarrh, when the sensations of rawness of the throat or tightness of the front of the chest first appear, the use of saline depressants and a moderate amount of opium is almost universally admitted to be the best line of action to adopt in the way of treatment by drugs. Vinum Antimoniale, ♏xv.; Potass. Nitrat., grs. x.; Spirit Æther. Nitros., ♏xxx., with Aq. Camph., oz. i., may be given every four hours during the first twenty-four hours of the attack, or if there be much oppression in the front of the chest, or other form of nervous irritability, the use of v. minim doses of Liq. Morph. Hyd., repeated frequently, till half a drachm has been taken, will often give relief more promptly. As soon as the more active symptoms of pain rawness, irritability, etc., pass off, and a freer secretion of mucus begins, it is well to use stimulant expectorants and of these the following combinations have often proved of service:—

℞ Acid. Hydrobromic, ʒss.
Syrup. Scill., ʒi.
Spirit Chloroform, ♏xv.
Aq. Dest., ℥i.

℞ Ammonii Carb., ♏v.
Tinct. Nuc. Vom., ♏x.
Tinct. Scill., ♏xx.
Tinct. Chloroform Co., ♏xv.
Aq. Dest., ℥i.

Coupled with this, the regular action of the bowels must be ensured by the use of saline draughts of Friedrichshall, or Hunyadi Janos, or Æsculap water on first rising, if the patient be not confined to bed. The use of liquorice powder ʒi. at night in hot water is preferable if the patient be kept entirely in bed, and a small dose of Calomel (gr. i.), or a pill containing Euonymin (grs. ii.), or Podophyllin (gr. ½), may be administered with advantage every second or third night. Quinine in ii. grain doses may also be given twice a day at this stage, in the form of pill or tabloid.

As soon as the symptoms and signs of bronchitis or bronchial catarrh have subsided, it is best to return at once to the line of treatment previously adopted for the phthisical condition.

Taking next into consideration those cases in which the tubercular lesion is more diffuse and has run a long and very slow course, the bronchitis becomes a much more serious feature, and is by no means so ready to depart as in the class of cases just mentioned. Where a chronic winter cough has been present for many years there are almost certain to be some permanent changes produced in the lungs, which render them less capable of recovery from fresh inflammatory attacks. Such are the presence of pleural adhesions, emphysema, and its consequent atelectasis, dilatation of bronchial tubes, retained bronchial secretions or bronchorrhœa, and enlarged glands. Added to all these are the structural changes brought about by the steady progress of the tubercular infiltration, often surrounding and involving the smaller tubes, and the various consequences to which they may lead.

Although the presence of such permanent structural alterations must of necessity diminish the powers of recovery from catarrh, it is nevertheless to be noted that

phthisical persons seldom suffer to the same extent from actual bronchitis as do those who are the subjects of gout or rheumatism. The attacks to which the latter are subject are maintained by the ever present sources of irritation in the blood itself. In tubercular cases the bar to recovery is more mechanical, and if, as often happens, the tubercular process is in itself inactive, giving rise to no increase of temperature or other evidence of constitutional poison, the bronchial inflammation is quite capable of recovery if the mechanical surroundings do not interfere too greatly with the blood and lymph channels, upon which the inflamed parts depend for proper nutrition. The conditions of the general, as well as the special, circulation have also a considerable influence in determining the recovery of the inflamed bronchial membranes, and of these the healthy condition of the right side of the heart is the most important, and, following upon that, the relative freedom from disease of the liver, kidneys, and other organs. Thus, in treating the bronchitis which attends advanced or prolonged phthisis, there are a large number of considerations to be taken into account before the right line of treatment can be ascertained with certainty.

In cases where the disease seems to have affected the larger tubes and the trachea, a great deal of relief may be given by the use of medicated steam inhalations, if due precautions are observed as indicated in the section on "Inhalation" (Chap. X.), but these are less applicable when the principal seat of the mischief is lower down. Hot fomentations to the front of the chest, medicated with a few drops of turpentine, will often serve the double purpose of a local counter-irritant and a means of inhaling the vapour of the drug.

In the bronchitis of the lesser tubes, the use of Iodide

of potassium has always been praised, whether in a simple form or combined with expectorants, such as Carbonate of Ammonium, Tincture of Squill, etc., or with Tincture of Stramonium in those cases in which spasmodic breathing is a common feature.

℞ Potass. Iodid., gr. v.
Tinct. Stramonii, ♏xx.
Tinct. Belladonn., ♏x.
Sp. Ammon. Aromat., ♏xv.
Aq. Dest., ℥i.

℞ Potass. Iodid., gr. v.
Tinct. Scill., ʒss.
Tinct. Camph. Co., ʒss.
Aq. Dest., ℥i.

The chronic cough, which is usually the chief distress for which relief is sought, can be much better combatted by means of diffusible stimulants, such as Æther and Ammonia, rather than by sedatives. Chloral Hydrate (gr. x.) or Sulphonal (gr. x.), combined with Tincture of Belladonna (♏ x.) and Aq. Camph., may sometimes be useful in cases where there is no cyanosis and where the secretion of urine is free, but opium is, if possible, to be avoided altogether in this class of case, and as a general rule the use of stimulants is to be preferred to that of sedatives. A little hot brandy or whisky and water, taken when the bronchitic cough is preventing sleep at night, will often be most successful in checking the one and inducing the other.

Any evidence of failure of the heart's vigour must be carefully watched for. The use of digitalis and strychnia may sometimes be required, and they should be used until their physiological action is made manifest. These remedies, like many others which exert a well-marked action, affect different individuals in very different degrees, and must needs be used with discretion, large doses being ordered if small doses appear to have no effect.

The condition of the liver and kidneys must in like

manner be looked to and their action stimulated, if such stimulation be called for. An occasional hepatic purge is very commonly required, and for these forms of bronchitis, Calomel, in doses suitable to the individual, but never in large doses, will be found the most satisfactory means of treatment. Podophyllin and Euonymin (gr. ½ and grs. ii. respectively) may be substituted in those cases in which, from any cause, the use of Calomel is objected to. The action of the bowels can best be regulated by daily doses of Liquid Extract of Cascara Sagrada (♏xx.) or Liquorice Powder (ʒi.).

Pleuritis may be the forerunner or the associate of tubercular disease in the lung at any of its stages. A very large proportion of the cases of simple pleuritis, with or without effusion, which are met with in practice have some former or latter connection with tubercular affections of the lungs or other organs. Whether they are set up in the first instance by actual tubercular changes in the visceral or parietal pleura it is next to impossible to determine, but in some cases there can be no doubt from pathological evidence that such is the case. So common are pleuritic affections in phthisis that a post-mortem examination which did not reveal the presence of adhesions in some part or other of the pleura would be almost a curiosity. In the records of 100 post-mortem examinations on cases of phthisis, taken at random from the books of Victoria Park Hospital, adhesions were present in every case. What the exact proportion may be which the true tubercular cases bear to those which have a non-specific origin it is not easy to determine, nor for purposes of treatment is it a matter of much importance, since in every case the pleurisy must be regarded as possibly tubercular and treated accordingly.

Localized patches of pleuritis are often to be discovered

in cases of phthisis in all stages, not of necessity in close proximity with the existing lesion, but often in remote parts of the chest. A slight pain or "stitch" may be the only symptom calling attention to it, and in many cases it may be only discovered in the course of routine examination, having arisen without causing any fresh symptoms at all. The friction sounds may be audible, and sometimes the friction may be palpable for a few days, and then the physical signs may completely disappear. In other cases fluid effusion may take place, and it is a striking characteristic of the pleurisy met with in the course of phthisis, whether it be attended with effusion or not, that it is prone to occur on both sides at once, or on one side shortly after the other, and that it is susceptible sometimes of very rapid recovery. Occasionally, but not commonly, the pleuritic fluid is blood-stained.

The relative frequency of such cases is approximately shown in the study of 100 cases taken from the post-mortem records of the same Hospital. In only nine of these was fluid effusion (apart from pneumothorax) discovered, and in only two of these was the fluid blood-stained, both being cases with tubercular deposit on the pleura. In the other cases the fluid was clear.

In association with pneumothorax there were seven cases of effusion, and of these the fluid was purulent in one case, clear in one case, turbid in three cases, and blood-stained in two cases.

Although a patch of pleuritis in a tubercular case may soon disappear and leave the patient apparently unaffected, the condition is by no means to be disregarded. It may, if neglected, be followed by considerable extension of pleuritis, and, perhaps, by a good deal of fluid effusion, or it may be due to an active tubercular process

in the lung close beneath the visceral pleura. In either case it is of the utmost importance to check the progress of the local mischief.

The patient must be clearly told what is taking place in his chest, and made to understand the importance of guarding against any extra strain or exertion of the lungs. The temperature must be closely watched, the affected part of the chest must be kept more particularly at rest by means of strapping, and all means should be used to check cough if it exists. Subcutaneous injections of Morphia may sometimes be necessary if there is an intolerable pain in the side, and Iodide of Potassium may assist the progress of recovery, but, as a rule, the persistent use of tonics and the maintenance of a steady routine of hygienic observance (of which we have given abundant details in other sections) will, coupled with the necessary rest and quiet, be the most effective means of treatment.

Pleuritic effusion is by no means a common occurrence in phthisis, and in cases where it has taken place the question of treatment requires careful consideration. Whether it be advisable to tap the fluid in such cases has been over and over again discussed, but never positively decided. As a general rule, if there be much tubercular disease of the lung on the same side, and if that disease has previously been showing symptoms of activity, the less the fluid is interfered with the better. Experience goes to show that the removal of fluid from the pleura when the lung which it covers, and, perhaps, the pleura itself, are the subjects of active tubercular disease in various stages, is not unfrequently followed by increase of the pulmonary disease, and very often by a still larger effusion into the pleura. Added to this experience of actual results it must be taken into consideration that the rapid removal of a large quantity of fluid seriously

disturbs the pneumatic balance within the chest. Hence there is considerable danger that with the attempted re-expansion of the lung some violence might be done to the pleuritic adhesions which, as we have shown, are always present in association with the tubercular lesion, and that by this means an escape of air into the pleural cavity might take place. A comparatively harmless effusion may thus be converted in a short time into a fatal pyo-pneumo-thorax. It is thus evident that while indiscriminate tapping may do no good, it is by no means unlikely to do considerable harm. The question remains for consideration whether it is ever admissible. It is only in the cases of very large effusion, where the pressure exercised by the volume of fluid is seriously hampering respiration or displacing the heart and pressing dangerously upon other organs, that removal of the fluid is undoubtedly necessary, and in such cases the operation should not be delayed when pressure symptoms have shown themselves. The tapping of these cases should, however, be only used for the purpose of withdrawing just so much fluid as will relieve the symptoms of pressure. The actual operation of tapping must be modified according to he nature of the fluid to be removed, and this can only be ascertained by a preliminary exploration. If the fluid be simply serous the tapping should be done through the smallest sized trochar. A perforated needle should never be used. The withdrawal of the fluid cannot be done too slowly, and the greatest care ought to be exercised in every case to see that the skin of the patient, the instruments, and the hands of the operator be made as clean and aseptic as possible.

In order to ensure the steady and gradual removal of the fluid it is necessary to use either a syphon tube or an aspirator. Of these the former is, no doubt, the simpler,

but it is open to several minor objections, which are small in themselves, but become important if they result in the admission of air into the pleura. The aspirator, however, must be proved to be in perfect working order before it is used, otherwise it is better to discard it altogether, and to trust to the syphon. The direct form of aspirator, Dieulafoy's, which practically consists of a large syringe, fitted with two exit pipes, guarded by a tap, the one to admit the fluid from the chest, and the other to empty the fluid away into a glass, is by far the best instrument for the purpose, as the amount of suction can be accurately regulated by the hand of the operator, and the removal of the fluid effected as slowly as he pleases without the sudden rush that is too often caused by careless use of these forms of aspirator which act upon the principle of drawing the fluid by atmospheric pressure into an exhausted bottle. By making use of a cannula fitted with a side tap, and an air-tight collar embracing the trochar, the entrance of air into the pleural cavity can be avoided with certainty.

By whatever method the fluid be removed it is absolutely essential that all instruments or tubes should be rendered aseptic, both internally and externally, before they are used. Boiling is perhaps the most effective means to that end, but it is not always easy or even possible to carry out. Thorough soaking in a solution of carbolic acid of strength 1 in 20 will usually suffice, and must never be neglected.

Pleuritic effusion in association with tubercle of the lung is more often met with as a result of pneumothorax than as a simple complication. In the large majority of cases in which pneumothorax takes place from the rupture of a tuberculous cavity, or any part of the pleura disorganized by the presence of pulmonary foci of

tubercle lying immediately beneath it, some amount of fluid effusion ensues.[1] It is usually milky or semi-purulent in appearance, but rarely serous. In some cases pus may be very soon poured out, and this may become offensive. It is impossible to forecast in any given case what may be the course of events after a pyo-pneumothorax has thus been induced, as everything depends upon the nature of the gases which escape into the pleura, and also whether any solid or fluid matters or specific micro-organisms also find their way into the cavity. The course of the temperature in such cases must be closely watched, and such symptoms as sweating or rigors looked for. As a rule, it is only when such evidences of general septic infection are present, over and above the symptoms that may be attributed to the initial disease in the lung, that any operative procedures are called for. When undertaken under these circumstances it should always be made quite clear to the patient that relief is the object sought for and not cure. The history of such cases after operation is not encouraging, but considerable relief may be brought to the symptoms of septic poisoning referred to. In the cases in which air and fluid are present in the pleural cavity, but in which no septic symptoms declare themselves, it is, as a rule, better to leave the chest condition alone, and strive by all possible means to maintain the general vigour. In one case treated during 1889-90 at Victoria Park Hospital pyo-pneumothorax occurred as a complication of a very limited degree of phthisis at the apex of the corresponding lung, and although the fluid had been proved to be sero-purulent, and a considerable quantity of it had been removed with the aspirator, it was nevertheless decided, on the re-accumulation of the fluid, to

[1] In it the presence of tubercle bacilli may often be demonstrated.

leave it alone, on the ground that no symptoms of septic poisoning were present, and the fluid when examined by the microscope appeared singularly free from micro-organisms and contained no tubercle bacilli. The patient gained flesh and was able to resume light work, and when seen eight or nine months after his discharge was found to be in fair health, although the amount of fluid in his chest was as great as ever. Such a case, if repeatedly tapped, could only have been affected for the worse. His lung already infiltrated with tubercle, from which bacilli could frequently be detected in the sputum, after so long a period of compression and in all probability firmly adherent to the chest wall, could never have expanded properly, while the removal of the fluid would no doubt have put a strain upon it which might easily have resulted in further rupture and escape of infective materials into the pleura, which in their turn would have set up septic symptoms and led to a rapid and fatal termination.

When the symptoms indicate that general septic infection is going on from changes taking place in the fluid, a free incision and the use of antiseptic washings should be adopted as the best means of relief, although in such cases the openings thus made are very rarely closed again during life.

Pneumothorax is by no means a rare complication of pulmonary phthisis, but is more often seen in the later stages of the disease when considerable structural changes have taken place in the lung, than in the more acute stages. The commonest cause for the condition is the rupture of a recently-formed superficial cavity, and in many instances the rupture may be traced to direct strain, as by violent exertion or excessive cough. It may, however, take place, as in the case of hæmorrhage, at a

time when the patient is lying absolutely still. It is not always possible to trace the exact position of the rupture on post-mortem examination, but the cases are rare in which no cavities are found in connection with pneumothorax. Tubercular nodules close to the surface of the lung and undergoing rapid degeneration may occasionally lead to perforation of the pleura, but such cases are the exception rather than the rule. Instances have also been recorded in which an extreme degree of emphysema has been present in the whole or part of one lung in association with tubercle, and in which the rupture has been due to the breaking of an emphysematous bulla.

The *symptoms* of the onset of pneumothorax are, as a rule, sufficiently characteristic, although the condition may in rare instances be set up very insidiously, so that its presence is only discovered on physical examination. When occurring suddenly, as it commonly does, pneumothorax is attended with acute pain, dyspnœa, and cough, coupled with great anxiety and a sensation of something moving in the chest on the affected side. The patient often becomes almost collapsed, but still endeavours to sit bolt upright and constantly shifts his position. The pulse generally becomes very rapid and small, sweating and a slight degree of cyanosis may be present, and the voice is reduced to a whisper. The physical signs are also very well-marked. The affected side is generally a little bulged and is kept motionless during respiration; percussion elicits a *resonant* note, but in all other respects the physical signs are as negative as in the case of a fluid effusion. Tactile vibration is almost entirely lost, the voice sound is diminished, and breath sounds cannot be heard. The heart is frequently displaced to one side.

however, there be a large opening between the cavity of the pleura and a cavity in the lung, a considerable

amount of amphoric breathing may be heard and pectoriloquy may be discovered. The classical "bell sound," which has been so often described as a positive sign of pneumothorax, is quite as often absent as present, and must not be too implicitly relied on. The "anvil sound" is much more commonly to be elicited.

In the *treatment* of pneumothorax it is first of all essential to allay the patient's fears as much as possible and to lead him to expect that his urgent symptoms are only likely to last a short time. In a few instances the obstruction to the breathing may become so great as to threaten immediate collapse and death, and in such cases no hesitation need be felt in at once tapping the chest with a medium-sized trochar, which should be withdrawn as soon as the first rush of air has brought relief to the symptoms, even though the stream of air has not entirely ceased to flow. Such active measures are, however, but rarely necessary. Hot flannels applied to the side on which the pains are felt, comfortable support by pillows, and the administration of a subcutaneous injection of Morphia, $\frac{1}{6}$ or $\frac{1}{4}$ of a grain, will generally bring relief after the first shock has passed away. Brandy (ʒi-ii.) or diffusible stimulants, such as Æther (♏xx.) and Carbonate of Ammonia (gr. vi.), should not be given unless the collapse is considerable and the pulse very small. A moderate degree of purgation after the first day by means of salines is generally advisable. The diet must be carefully adapted to the circumstances of the case, the main point being held in view that any flatulent distension will inevitably tend to increase the patient's sufferings.

An escape of air into the pleural cavity, either from the lungs or from a wound in the parietal pleura, does not of necessity give rise to collapse of the lung (as was

formerly supposed), or to complete filling of the pleural cavity with such air. A certain amount of force is necessary to separate the visceral from the parietal layer of the pleura, and in the great majority of cases of pneumothorax this force is supplied by the straining and coughing to which the first escape of air may give rise. Hence it is of the utmost importance in such a case, where the pleural cavity is as yet only partially distended with air, to moderate the cough as much as possible to prevent further separation of the pleural layers from taking place.

This is not always easy to accomplish, but a good deal may often be done by persuading the patient to resist the tendency to a violent explosive cough as much as possible, and sometimes by fixing the affected side with broad pieces of strapping. In cases where the forcible separation of the pleural layers has only taken place over a limited area, the absorption of the air may be complete, and the lung may be fully re-expanded. This, however, depends to a great extent upon the nature of the extravasated air, and upon the presence or absence of fluid effusion. Even in the presence of a moderate amount of effusion, however, the air may be absorbed to a very considerable extent, although such cases are rare.

Bronchial Glands.—Very few post-mortem examinations on cases of phthisis are recorded in which there were not found some affection of the tracheal or bronchial glands. Enlargement is the most obvious of the changes to which these glands are subject. This enlargement may, however, be due to many causes. The whole substance of the gland may be found in a hyperæmic condition, with every appearance of active inflammation, with or without actual visible tubercular deposit. In another case the glands may be found engorged with venous

blood, œdematous and soft, or in another class of case they may be hard and almost fibrous to the touch, the result apparently of bygone inflammation or tubercular infiltration. Added to all these are the cases in which the whole or part of the gland has undergone caseous degeneration, or may even present all the conditions of an abscess enclosed within a capsule. All these diverse pathological conditions are liable at one time or another to complicate cases of phthisis, but it must be confessed that they are almost all of them as difficult to diagnose with certainty as to treat with success.

Of 130 post-mortem reports, taken without special selection, only six cases are reported of normal bronchial glands. Nineteen cases showed caseous changes, and four calcareous masses. The rest were enlarged, but not all affected by tubercle.

Enlargement of these glands, and especially that form of enlargement which depends upon actual tubercular infiltration, is a condition which deserves something more than passing mention among the complications of phthisis. It is in the case of phthisis in childhood that the part which they play comes into strongest prominence. It is within the experience of all morbid anatomists that cases are apt to occur of acute tuberculosis in children in whom the only apparent starting-point of the acute disease is found to be a single caseous bronchial gland. No other tubercular lesion of anything like the same age as this gland is discoverable, and the question arises how did such a gland become tuberculous in the first instance? The answer to this question must be sought in the previous medical history of the case, and it is usually found that a prolonged attack of measles or of whooping cough, or some one of the many infectious diseases to which children are susceptible, has preceded the appearance of

the phthisis. It is well recognized as a fact that in almost all catarrhal affections of the lungs or bronchi a greater or less degree of enlargement of bronchial glands is prone to occur, just as the corresponding lymphatic glands in the neck are prone to implication when the tonsils are inflamed from any specific cause. Looking at these undoubted facts side by side it will at once be clear that the occurrence of any of the specific diseases of childhood which may be attended with bronchial catarrh, or any more serious implication of the air-passages, should lead us to recognize the possibility of some residual deposit in the bronchial glands, even though there be no symptoms present which call special attention to any such possibility. More particularly must this be the case when the patient exhibits any of the recognized features which we are accustomed to regard as predisposing to tubercular disease. By what means these glands become storehouses of tubercular material after attacks of illness which, as far as present knowledge extends, are not in any direct way connected with tubercle, is a matter for speculation, but for the present purpose of considering how such cases can best be treated it is not necessary to go beyond the bare clinical fact, which rests upon so strong a basis of pathological observation that it is universally accepted.[1]

Children who have passed through an attack of whoop-

[1] In an earlier chapter it will be remembered that according to Dr. Sims-Woodhead the bronchial glands may become tubercular by means of tonsillar infection, the most probable vehicle of infection being raw or unboiled milk. Koch seems to suggest also that inhaled tubercle bacilli may pass from the pulmonary alveoli direct into the lymph stream without first of all setting up tubercle in the lung itself. The bacilli would thus be able to reach the bronchial glands, and under certain conditions might set up in them the tubercular process ("The Etiology of Tubercle," New Sydenham Society's Translation, p. 195).

ing cough, measles, or varicella, especially if the attack has been complicated with much bronchial catarrh, apt to continue in a condition of ill-health without any very definite symptoms for long periods, and frequently are only benefited by change of air and surroundings, the sea-side being essentially beneficial to them. Often this condition of ill-health is accompanied by an occasional paroxysma cough, distinct from whooping-cough, but at the same time paroxysmal in its onset and peculiarly dry and harsh in its sound. It may be present for a few days and then entirely disappear, but may return after an interval, and with each return its essential characters are the same. From the tone of the cough and the sudden way in which it occurs without any obvious cause, one is driven to the conclusion that some source of nervous irritation is at work, and amongst other possibilities the condition of the bronchial glands must be thought of.

The diagnosis of enlargement of any of these glands is very difficult, since they are rarely enlarged to a great extent, although in some cases they become sufficiently large to exercise considerable pressure upon the bronchi or upon the large venous trunks. When this is the case a diminution of the volume of the inspiratory sound heard over the lung on the affected side would be produced, and in some instances a unilateral catarrh has been set up and maintained in the larger tubes in the immediate neighbourhood of the pressure. Partial obstruction to the vein trunks produces swelling and œdema of one or both sides of the face. But long before the enlargement is sufficient to produce mechanical pressure upon the tubes or veins a very considerable amount of influence is brought to bear upon the nerves of the mediastinum, which lie in such close relation to some of the glands. Upon these the effect is not merely mechani-

cal. As already stated, it is by no means uncommon to find the glands in a state of active inflammation, without much enlargement, and where this is the case direct irritation is of necessity set up in the network of nerve fibres which lie in closest relation, sometimes in actual close contact, with the affected glands. The diagnosis must rest upon symptomatic evidence for the most part arrived at by the exclusion of other sources of reflex irritation which might set up the cough referred to. This is not by any means easy to accomplish if there be actual changes in the lung, but usually the character of the cough will in itself be sufficient to rouse suspicions that it is not wholly due to actual pulmonary disease. Pain as an evidence of enlargement of bronchial glands is a most untrustworthy symptom. Dyspnœa, if paroxysmal and occurring like the cough, at intervals with complete remissions between them, must always be noted.

It has been pointed out that in cases of enlarged bronchial glands there may sometimes be noted an irregularity in the size of the pupils. This depends upon disturbance of the large cervical sympathetic ganglia, which in turn influence the function of the long ciliary nerves.

This symptom, although aiding considerably in the diagnosis when it is met with, is very frequently wanting, being obviously dependent, not upon enlargement of bronchial glands only, but on the extent of that enlargement.

The physical signs of bronchial gland enlargement, unless it be so great as to cause pressure upon neighbouring organs, are very uncertain. In a few cases some changes may be found on auscultation close to the spine at the level of the 1st, 2nd, or 3rd dorsal vertebra. Distant bronchial breathing, or merely a harsh prolonga-

tion of the expiratory sound, may be made out, with corresponding increase of the vocal resonance in the same area.

In his work on "Disease in Children," Dr. Eustace Smith describes a method of physical examination by which he believes that enlarged bronchial glands may be easily discovered in children. Dulness over the upper part of the sternum is only present when the enlargement is considerable and the enlarged glands are in contact with the chest wall. Dulness between the scapulæ he has never met with. If the swelling be large enough to produce pressure on the veins, congestion and œdema will follow, but "long before the ordinary signs of pressure on the vessels can be detected, we can induce pressure on the vein if the bronchial glands are enlarged. If the child be directed to bend his head backwards upon his shoulders, so that his face be turned upwards to the ceiling above him, a venous hum which varies in intensity according to the size and position of the swollen glands may be heard with the stethoscope placed upon the upper bone of the sternum." The lower end of the trachea and the glands in the bifurcation are presumably tilted forward and the innominate vein is compressed.

Such signs, like those of pressure, are only valuable in so far that they reveal the existence of solid masses. They do not tell us whether such masses are active or passive. For this information we can only trust to the paroxysmal dyspnœa and cough, and we are forced to assume that the glands which give rise to them are subject to occasional irritation and extra enlargement, just as is seen in the case of the enlarged glands higher up in the neck, which also are connected in their origin with tubercle, and which are subject to occasional periods of tenderness and enlargement.

In all cases where the approximate diagnosis of enlarged glands is thus made possible, it is of the utmost importance to maintain the general processes of nutrition, and especially to favour in every possible way the activity of the circulation.

This can best be accomplished by insistance upon abundance of fresh air and exercise, particularly the latter. Children and young persons who are either recovering from attacks of specific disease or who are already the subjects of phthisis, are frequently languid and disinclined to energy, preferring to remain in a warm room or to sit over a fire rather than to take active exercise out of doors.

This tendency must be firmly combatted and a certain amount of daily exercise provided for, whether it be indoors or in the open air. The more fully the processes of nutrition are kept in activity the less likelihood is there of accumulation in lymphatic glands. Change of air, and especially to the sea-side in a mountainous district, or in England to the south-east coast, to such places as Westgate, Margate, Broadstairs, Ramsgate, and Deal, has always been recognized as a potent means of improving the condition of the so-called "strumous" habit of body, and in every case where there exist good grounds for suspecting the presence of enlarged bronchial glands such a change becomes of the greatest importance, since abundant evidence exists of the evil that may be wrought from such glands becoming storehouses of tubercle, ready at any time to reinfect the general organism from their store. But mere change of air is not of itself sufficient, and requires to be supplemented by all means which tend to the promotion of tissue change and active circulation—active exercise on the hill-side, if the patient can take it for himself, or systematic massage if for any cause he be

incapacitated from walking. Baths, douches and gymnastic exercise may be employed in suitable cases, but whatever form of treatment be thought best for each individual case it should be steadily persevered with for several weeks, even if distasteful to the patient, provided that no prejudicial effects are produced.

The indoor exercises of dancing and the use of the skipping-rope may be encouraged with advantage in the cases of young children.

Treatment by drugs is rarely satisfactory in these cases. Iodides and Cod-liver oil, Parrish's Food, Maltine, and other aids to digestion are among those most frequently employed, but, as a general rule, the less drugs are relied upon and the more attention that is bestowed upon the use of abundant fresh air and exercise the better. So long as nutrition is fairly maintained and ordinary plain food satisfactorily digested it is wiser to abstain from physic. If nutrition be not well maintained and if there be any loss of flesh or failure of function of liver, stomach, or intestines, it then becomes necessary to aid the processes of nature by means of a dose of Hydrarg. c. Creta (grs. iii.) or a dose of Calomel (gr. ½ to i.) every alternate night, supplemented by the addition of a pinch of powdered Carlsbad salt with every meal (about xx-xxx. grains daily being so administered). If there be tendency to anæmia, notwithstanding free exercise in fresh air, any easily assimilable preparation of iron may be given, the Syrup of the Phosphate (ʒs. to ʒi.), or a similar dose of the Compound Syrup—Parrish's Food—or the Citrate of Iron and Ammonia (grs. v-x.). A good supply of creamy milk will take the place of cod-liver oil. Persistent ill-health, which remains unimproved by such methods as these, will generally be found to be dependent upon some more serious condition than

residual enlargement of bronchial glands, and special treatment will be requisite according to the nature of the case.

Enlargement of the cervical chains of glands[1] is so common an occurrence that a very large proportion of young consumptive adults bear traces of their former or latter presence in the shape of scars or swellings in the neck. Acting on the principle that tubercular foci should be removed wherever they admit of removal, we ought, perhaps, to counsel the removal of all such glands directly they show signs of irritation. Such counsel would, however, carry us beyond the needs of the case. It is now well known that tubercular infection may pass from the surface, say, of the tonsil, and may be carried to the first glands in relation with it. But it does not of necessity follow that a general infection of the lymphatic system will ensue. In passing through a healthy gland tubercular virus has to encounter the antagonism of the lymph cells, and is frequently completely annihilated before it can pass to the chain of glands beyond. This natural process, which was formerly vaguely assumed under the name of "vis medicatrix naturæ," has now been clearly demonstrated, and must always be taken into account in dealing with such conditions as we refer to. It is the common experience of everyone that after some forms of sore-throat the neighbouring lymphatic glands become tender if not actually enlarged. That tenderness is the expression of the cellular activity within the gland, called into being by the presence of a foreign *materies morbi*. The tenderness often remains limited to one gland, and in

[1] Koch says: "I could explain a number of cases where extirpation of cheesy cervical lymphatic glands had been performed in otherwise healthy adults only by supposing that they were due to *infections through abrasions of the scalp.*"

a few days it subsides. The *materies morbi* has been annihilated. Occasionally, however, the tenderness and enlargement shows itself in a second or, perhaps, a third series of glands, and even after all tenderness has passed away the glands remain somewhat swelled. Finally the swelled glands may become caseous in parts, and the presence of the disintegrating material sets up inflammation and subsequently suppuration. From these facts it will at once become clear that the removal of glands directly they show signs of having become tuberculous would be unreasonable. So long as the glands retain their functional activity they are in themselves more a source of protection than of danger to the body generally. In the case of caseous degeneration, however, they constitute more of a danger than a safeguard, and hence we should advocate the removal of caseating glands as soon as the first signs of degeneration become manifest. The same may be said of glands occurring elsewhere than in the neck, but the axillary and crural glands are much less likely to become infected with tubercle, and hence the question of their removal arises but seldom.

Emphysema and Atelectasis.—Emphysema is not of itself a complication that often demands attention in the course of treatment of phthisis. It is, however, present in a very large proportion of cases of the chronic disease, but does not of necessity give rise to signs or symptoms which are likely to attract much notice. At the free edges of the lungs and about contracting cavities there will almost always be found more or less emphysema, and this fact must be borne in mind when estimating the value of the physical signs observed in such situations. The emphysema almost always leads to more or less diminution in the volume of the inspiratory murmur and to slight increase in the resonance to percussion.

In association with chronic bronchitic changes there are, as already mentioned, a great number of other structural changes liable to occur in the lung tissue, and among these emphysema is prominent, adding on the one hand to the severity of the dyspnœa and on the other to the difficulty of expectoration.

It has been often noted that lungs which have been the subject of acute tuberculosis are found to be emphysematous throughout their whole extent. This general emphysema is probably the result of the sudden and widespread obstruction to the finer tubes which is caused by the formation of the tubercles about them.

It was formerly supposed that some kind of antagonism existed between tubercular disease and emphysema, probably founded upon the fact that the latter is usually met with in association with chronic or healed disease.

In a few instances the occurrence of pneumo-thorax may be attributed to the rupture of emphysematous tissue, but a far more common cause is the giving way of a part of the lung which has been disorganized by tubercle. Cases are sometimes recorded, too, where subcutaneous emphysema has followed such rupture.

Collapse and wasting of the vesicles in the parenchyma of the lung may occur as a secondary result of emphysema, and are usually met with to a greater or less extent in those cases of chronic phthisis which have been for years associated with bronchitis and its sequelæ. As seen in clinical practice atelectasis is generally met with in persons past middle life who have been the subject of chronic quiescent phthisis for many years. The chief symptom to which it gives rise is chronic dyspnœa. The patient, generally a man of small and wasted frame and a shrunken chest, complains that he is at all times short of breath, and that his dyspnœa is aggravated by exertion. Some-

times a slight degree of cyanosis is present, but in other respects the patient may be free of symptoms of lung or heart mischief. Although liable to coughs and colds, these troubles are not always manifest. The shortness of breath is the one complaint, other functions being frequently quite normal. The tubercular disease which has been the starting-point of the disease in the lungs is often perfectly quiescent, and on post-mortem examination only fibroid changes can be found. It is a striking fact, referred to elsewhere, with regard to this class of case that in a large proportion of the post-mortem records it appears that the patient died suddenly in the street, and was brought into hospital dead. The condition of the lungs in such cases generally showed that the wasting and shrinkage had progressed to such an extreme degree that the amount of healthy lung tissue available for respiration was reduced to a very small minimum, and that the onset of a slight catarrh had been enough to suffocate the patient. The process of atelectasis would thus seem to be tolerated by the lung up to the extreme limit of respiratory possibility, provided that it takes place with sufficient slowness.

Very little can be done in the way of treatment to check or minimize the collapse of those parts of the lung which have been irreparably damaged by the emphysematous changes which precede the collapse. Many attempts have been made by the use of inhalation of air at different degrees of density to re-expand the tissue which has fallen in. So long as the expanding influences are maintained, so long may positive results be observed in such cases, but as soon as the abnormal conditions of respiration are removed the lung as a rule soon falls again into its former condition. Persons who devote a long time to residence in the rarefied atmosphere in some of the

Alpine health resorts not unfrequently show a very marked expansion of hitherto collapsed lung. More especially is this seen in the cases of quiescent disease at one or both apices where the pulmonary tissue round about the scarred apex has become collapsed and supra-clavicular fossæ have become very hollow. By slow degrees it may be noted that these depressed hollows become gradually filled up, and percussion over them gives once more a fully resonant or hyper-resonant note. This condition, however, soon disappears when the patient resumes life at the ordinary altitudes, and has to respire air at the normal pressure. Such expansion may be artificially induced by the use of air baths or by means of special pneumatic inhalers, formed on the principle of the accordion, by which rarefied air can be respired for several hours together. The effects produced are as a rule only temporary, since the balance of pressure is not equalized, the external atmospheric pressure being greater than that of the inspired air, thus differing essentially from the conditions at high altitudes where the internal and external pressures are equal.

Much of the advantage that is derived from residence at high altitudes is no doubt due to the increased area of oxygenation, and heuce more active tissue change, which is induced by expansion of parts of the lung which under ordinary circumstances would remain almost entirely airless. In parts thus rendered stagnant, accumulation of effete products must take place to a greater or less degree, and the removal of these must of itself be no small factor in the process of repair in the parts around.

Cardiac.—The heart in cases of phthisis, as in most wasting diseases, is, as a rule, small. This smallness has been by some observers regarded as the cause rather than as the consequence of the general body wasting, and congenital

smallness of the organ consequently looked upon as one of the points in the etiology which may be classified as a "predisposing cause." The rarity of heart disease in association with phthisis has, in like manner, given rise to a belief that some occult antagonism exists between the two diseases. The systematic study of post-mortem records in cases of phthisis proves that neither of these views may be accepted without considerable qualification.

On analyzing 133 post-mortem reports, all carefully recorded by skilled pathologists, the heart is recorded as "healthy" in the vast majority. Of the abnormal conditions, smallness is no doubt the most frequently mentioned. In seven cases only was hypertrophy found, and in only two is there any note of dilatation. The heart muscle was found pale and flabby in only six cases, but in most of those the heart itself was not of abnormal size. Valvular lesions were present in 24 cases, and of these the mitral valve was constricted in three instances, fringed with vegetations in four, and thickened in eight cases. The aortic valves were affected five times and the tricuspid valve four times. In many cases a small quantity of fluid was found in the pericardium, in two cases acute pericarditis was present, firm adhesions in one case, and acute tubercular pericarditis in four cases. In all the last-mentioned cases the tubercles were thinly scattered about the base of the heart, and in only one instance was there any invasion of the heart muscle itself.

From this analysis it is evident that the proportion of heart affections in the course of phthisis is by no means so small as to lead to the supposition that any antagonism exists. It will be noted that simple dilatation of the right ventricle is but rarely met with, and this notwithstanding the fact that the chronic disease in the lungs

must for a long period have been obstructing the flow of the circulation through the branches of the pulmonary artery.

Apart from definite pathological lesions, the heart in the case of young consumptive patients is often a source of trouble. Patients whose occupations confine them much within doors—clerks, teachers, dressmakers, and others—not unfrequently complain of palpitation, associated with abnormally loud heart sounds and a jerky heaving action of the whole organ. This condition, however, must not be regarded as directly connected with the specific disease, but rather as an indication that the disease and the patient's surroundings are, together, proving too great a strain on his general powers. Overwork, over-anxiety, a constantly stooping position, insufficient supply of pure air, over-indulgence in alcohol, venereal excitement, etc., may be added, and careful inquiry must be made into the presence of any of these before satisfactory treatment can be applied. At all stages of consumption cardiac symptoms are liable to be present from the simple cause of anæmia. When this can be ascertained, preparations of iron or of iron and arsenic or strychnia should not be omitted.

℞ Liq. Arsenical, ♏v.
Ferri et Ammon. Citrat., grs. x.
Spirit Chloroform, ♏xv.
Aq. Dest., ℥i.

℞ Tinct. Ferri Perchlor., ♏x.
Liq. Strych., ♏v.
Syrup Aurant., ♏xxx.
Aq. Dest., ℥i.

In dealing with anæmia in these cases it is no less necessary to maintain the free action of the bowels during the administration of iron than when the blood condition is uncomplicated with the presence of specific disease.

Attention to the amount and quality of the sleep which the patient obtains is also an important factor in successful treatment of this cardiac excitement in cases of early

phthisis. Light and pervious clothing should be insisted upon, the occasional use of a hot bath at bedtime during cold weather, avoidance of late meals or late smoking, but, above all things, absolute regularity in time of going to bed must be inculcated. Sleep may sometimes be interfered with by the unrecognized presence of an overloaded rectum, especially in those cases where piles or a fistula are present. A simple enema and a little citrine ointment applied before getting into bed will remedy this trouble. It is not advisable to use direct narcotics till all other means have been found to fail. Only in the later stages of the disease, when recovery can no longer be thought of, may sedatives be used freely for this purpose.

Although, as we have pointed out, definite lesions, both of endocardium and of pericardium, are liable to be met with post-mortem, these lesions are but rarely diagnosed during life. Of the endocardial lesions it will be noted that they are chronic and insidious in their progress, and it is probable that most of the pericardial lesions take place shortly before death. In neither case are definite physical signs or symptoms likely to be produced.

Morbid growths sometimes occur as complications of phthisis, but they are by no means common. They rarely attack the apices of the lungs in the first instance, but are generally found to have encroached upon the pulmonary parenchyma from the root of the lung. Their onset may thus be insidious and unsuspected, and their progress may even have advanced so far before detection as to give rise to physical signs of dulness, absent breathing, and bronchophony at any part of the chest. The persistence of these signs without the changes which commonly follow upon complete tubercular consolidation, coupled with the rapid wasting, cachexia, and sometimes with signs of

disease due to secondary deposits in other organs, will generally enable a correct diagnosis to be made. More puzzling and less easy to detect than the infiltrating growths are hydatid cysts. These may occur at any part of the lung, and when present at the extreme apex on one side they may give rise to symptoms and even to physical signs which are hardly to be distinguished from those set up by tubercular deposit. The following case illustrates this difficulty:—A little girl, the subject of cerebral tumour which was believed to be tubercular in nature (the family history bearing strong testimony to a tubercular tendency), was suddenly seized with hæmoptysis, followed by cough, rise of temperature, and general febrile disturbance. On examination the apex of the left upper lobe was found to be affected. The percussion note was impaired, the breath-sounds were feeble in volume and bronchial in character, and there were abundant râles audible in the affected area. The presumption, therefore, was in favour of an acute development of tubercular disease in the lung, possibly around some latent focus. The child died from the brain disease, and, on examination, large hydatid cysts were found in the brain and in the apex of the affected lung, but no tubercular disease in any part.

Almost every kind of morbid growth has been recorded as occurring in the lungs or in the pleura, but in the vast majority of cases they have been in the form of secondary deposits, the primary disease being seated elsewhere. Such growths may occasionally occur in tuberculous subjects, but statistical evidence goes to prove that there is no affinity or antagonism between the two conditions. Morbid growths of the lung are not of common occurrence, but there is no striking disproportion between the number of cases in which the growth occurs independently or in association with phthisis.

From the point of view of treatment, the more certain the evidence of sarcoma or carcinoma the less hope there is even of temporary success. The relief of symptoms which distress the patient is all that can be aimed at. If there be no special distress produced there can be no object in applying remedies such as iodide of potassium or local applications. The less the patient's mind is allowed to dwell upon his disease the better it will be for him, and hence efforts should rather be made to occupy his attention with affairs unconnected with disease, and to give as little physic as possible.

Affections of the Chest Walls and Spinal Column.—Among the various complications which affect the progress of phthisis any abnormal condition of the chest walls must of necessity play a considerable part. Disease of the spinal column may in itself be set up by a tubercular process, and so long as the disease in it is active it generally happens that the disease in the lung is for the time quiescent. The direct influence which the spinal disease has upon the course of the consumption is chiefly mechanical. When curvature takes place, as in the greater number of cases it does, the natural curve of the ribs is distorted and full and complete respiration is interfered with, and hence the available respiratory area is still further diminished. Relief can sometimes be afforded in such cases by the use of mechanical support to the chest, as by the plaster-of-Paris or poro-plastic jacket. The application of these artificial supports must be carried out either by the means of suspension, as suggested by the late Professor Sayre, or by some other method, such as the recumbent position, which shall ensure that the weight of the patient's head is taken off the spinal column while the rigid casing is being applied to the chest.

Prolonged treatment by rest in the recumbent position

is sometimes necessary, and may occasionally be found to suit the sufferer from tubercular disease of both spine and lung remarkably well, provided that arrangements are made whereby the patient can be out of doors in a "spinal carriage" whenever the weather permits.

In some cases of chronic disease where there has been a great deal of disease at or about the apex of the lungs on one or both sides, a marked falling in of the chest wall takes place. This is a matter which often distresses the patient, and hence it should always be made clear to him that such a falling-in is advantageous rather than the reverse.

Collapse and shrinkage of the diseased lung is the best course for the healing process to take, and generally indicates that the disease is becoming fibroid after removal of the disorganized tissue.

So long as this falling-in is confined to the apices it should not be interfered with. When, however, it occurs at the bases of the lungs in front, producing deep depressions below the nipples on either side, the encroachment upon the respiratory area becomes much more serious. In young patients some improvement to this condition may be obtained by carefully compressing the lower ribs and upper part of the abdomen by bandaging so as to throw as much work as possible upon the upper part of the thorax. Where facilities are at hand for the employment of compressed air, some relief may also be obtained by that means, and the influence of the rarefied air of high altitudes has been found to cause considerable re-expansion of a contracted chest wall in young subjects. In the cases of older people, when ossification has begun in the ribs, no mechanical contrivance is of much avail, and the patient must perforce adapt his mode of life and amount of exercise to his respiratory powers.

Non-Thoracic Complications.—Affections of the Nose.—Tubercle is not often met with as affecting the nasal passages, even in cases where there are marked lesions in the mouth or larynx. When present it is usually seen at or about the anterior opening of the nostrils in the form of small nodular and indolent swellings, or as superficial ulceration covered with adherent crusts. The nodular swelling may remain unaltered for a long time, but usually becomes slowly disintegrated, and ultimately breaks down into a flat ulcer, which shows but little disposition to heal, unless it be kept constantly cleansed and stimulated. In a few instances it has been possible to find bacilli in the disintegrated tissue of such swellings, but in several well-marked cases which have been thoroughly searched, no bacilli have been found. The gradual infiltration, the slow course, and the indolent nature of the whole process would always lead to the suspicion of tubercle when occurring in a person who is already the subject of tuberculosis elsewhere. Miliary deposit of tubercle within the nasal cavity is hardly ever seen. Superficial ulceration on the other hand is not a very uncommon condition. The ulcers appear as a rule without much surrounding inflammation. A slightly raised and reddish margin, and a surface closely covered with crusts, situated just within the nostrils and occasionally on the septum, are the conditions most frequently met with. When the crusts are removed the surface of the ulcer is usually found to be rather indolent in appearance, and with very little vascularity; sometimes greyish specks may be seen in the floor of such ulcers, but they cannot be made out in every case. These superficial ulcerations are not found to bear any definite relation to the presence of tubercle elsewhere in the upper air passages, and they

may be met with sometimes in cases where the mouth and larynx are absolutely free from any indications of tubercle. Tubercular masses or tumours have been described as occurring in the posterior parts of the nasal passages, sometimes causing obstruction, but their occurrence is undoubtedly rare.

The *treatment* of tubercular ulceration in any part of the nose that can be effectively got at, should be obliterative. The surface of each ulcer should be carefully cleansed, and lactic acid should be applied with a firm hand. A moderate amount of scraping of the surface is sometimes necessary if there be a considerable amount of soft infiltration, in order that all the tubercular tissue may if possible be removed before the acid is applied. The use of a solution of cocain beforehand of 20 per cent. strength will serve to render the operation less painful.

Apart, however, from actual tubercular lesions in the nose, it is of the greatest importance in treating cases of consumption, at any period of its course, to see that the nasal passages are free from obstructions of any kind. Swelling of the inferior turbinate body, polypus, adenoid growths, or any other cause of obstruction must if possible be cleared away, unless indeed the patient be in so far advanced a stage of lung disease as to be beyond the hope of relief.

Affections of the Ear.—Affections of the ear are not by any means common in association with tubercular disease of the lungs. Deafness and other symptoms of aural mischief are but rarely met with even in the later stages of the pulmonary disease, and more rarely still in the earlier stages. The records of large numbers of cases in our own hospital go to prove the truth of this assertion, and it is fully borne out by the records of observers in other countries who have similarly large opportunities.

From the clinic of Professor Wagner in Leipsig, for instance, a careful record by Dr. Moldenhauer gives a frequency of only 2·4 per cent. of aural affections in cases of phthisis. In some of the few cases which in the course of several years we have had occasion to examine, it has generally been found that the deafness or other symptom has been due to some one or other of the preventable or curable conditions which have nothing to do with tubercular disease.

Cases, however, occur from time to time in which the tubercular process is at work. The seat of disease in such cases is almost invariably the middle ear. It has been assumed that the bacilli gain access to the tympanum by way of the Eustachian tubes, and that any previous diseased condition of the tympanum may assist the development of the tubercle when it has been so introduced. As against this theory it must be remembered that the current of ciliary movement in the Eustachian tubes is in the direction from tympanum to pharynx. Be this as it may, clinical evidence goes to prove that where tubercular disease is set up in the tympanum, a catarrhal condition of the middle ear has very often preceded it. The disease would appear to attack the lining membrane of the tympanum, at first infiltrating, then giving rise to swelling and separation from the bone, and at last to a general destruction of the soft parts, completely disorganizing the middle ear. The progress of these events is, however, slow and insidious, and is not as a rule accompanied with much pain. Hence, although the deafness increases, the patient does not complain or seek for special treatment. Thus it comes about that the early stages which lead to this destructive result are but seldom seen by the physician. Even where attention is called to them in the early stages, there

is very little to be learnt by examination, unless indeed the membrana tympani has been perforated, in which case the condition of the middle ear can be seen, and the discharges from it searched microscopically. In a very few instances we have met with acute pain in the ear set up by a rapid tubercular process, but the disease in such cases is generally associated with tubercular meningitis. The occurrence of miliary tubercles upon the membrana tympani has been recorded by some observers, but we have never had the opportunity of seeing such a phenomenon. In dealing with aural complications, therefore, when they occur it is necessary in the first instance to make sure that the morbid changes are really tubercular and not only of a simple kind. From the possible sequence of tubercular disease a special interest attaches to catarrh of the middle ear occurring in a tubercular person, and measures should be at once taken to keep open the Eustachian tubes, and to apply counter-irritation where such a condition is present without rupture of the membrana tympani. Where such rupture has taken place, it is possible to maintain free drainage and to keep the interior of the tympanum clean by injections of weak solutions of warm Boracic Acid and by the application of Iodoform, with or without the addition of a little Morphia, the object being not so much to cure the diseased conditions of the middle ear as to prevent the further extension of the disease to mastoid cells or to the meninges of the brain.

The Tongue, Pharynx, and Tonsils.—The condition of the tongue as an index of gastric disturbance is untrustworthy. It may be furred or it may be clean, and although the former condition is most frequently met with, the actual proportion is not great enough to permit us to lay much stress on the sign. Of 63 cases in which

symptoms of dyspepsia or actual vomiting were marked clinical features, we find the tongue recorded as clean in no less than 20 instances. As an index of intestinal abnormality it is still less to be relied upon. Of 66 cases of irregular or constipated bowels the tongue was found clean in 37 and furred in 39, and of 113 cases in which the bowel function was perfectly normal, the tongue was clean in 56 cases and furred in 57. (These figures are taken from our own private notes and not from the ordinary ward reports.) From these observations it will be seen that the conclusion arrived at by Louis as the result of his "Researches" at the beginning of the 19th century are fully borne out at its close. He says:—"At least it must appear to everyone perfectly obvious from the facts now passed in review that there exists no necessary connection between the state of the tongue and the state of the stomach."

Apart, however, from the common variations in the state of the tongue, we have to consider the class of cases in which the tongue is in itself the seat of primary or secondary tubercular disease. Such cases are rare, but they have of late years been recorded sufficiently often to render the question of their treatment of considerable importance. Many cases are now on record in which ulcers of the tongue, generally situated upon its sides or tip, very rarely on the dorsum, have been proved by microscopic examination to be undoubtedly tubercular, and although in the majority of cases they have been accompanied by definite evidence of tubercular disease in the lungs or elsewhere, there are, nevertheless, others in which no such connection can be discovered, and which must be assumed to be primary. Under either condition the presence of actual tubercular disease in the mouth, whether it be on the tongue or on the pharynx, must be

held as an indication for active treatment, except, perhaps, in the last stages of the disease when the patient's end is approaching. With increased knowledge of the nature and history of tubercle there has been more and more unanimity in the minds of physicians and surgeons as to the necessity for its removal whenever it manifests itself in a part of the body from which it can be satisfactorily taken away. In other words it has come to be regarded in much the same light as a malignant growth, and hence to be subjected to radical treatment whenever such treatment can be applied with reasonable hope of success. Thus in such easily accessible parts as the tongue and the pharynx no hesitation need be felt in advising operative measures. That such measures are not always successful, and that recurrence is liable to take place at or about the same spot, cannot be held as a good argument for withholding any operative procedures.

Very early forms of tubercular erosion may be met with, generally about the tip or sides of the tongue, and these can be often arrested and healed by the application of Lactic Acid, either with or without curetting the surface of the erosion. Failing success with solutions of 50 per cent. strength, the pure acid may be used. If recurrence take place, a deeper and more thorough curetting, with subsequent destruction of the tissues in contiguity with the ulcer with actual cautery, should unquestionably be undertaken in all cases where the patient's state is not too far gone to admit of the prospect of healing. A careful distinction must, however, be made between the treatment of superficial ulcers and those which have already penetrated into the deeper structures.

In his work on "The Tongue and its Diseases," Mr. Butlin describes the occurrence of very early tubercular lesions on the tip or sides of the tongue, in the form of

fissures, stellate and irregularly branched. These fissures may extend deeply into the substance of the tongue; becoming ulcerated and finally forming superficial ulcers. The chief distinctions of such ulcers are their sharp-cut but not elevated edges, seldom everted or undermined, not very red, and with but little surrounding induration, the tissues about them being generally a little sodden. These ulcers may heal for a time after treatment, but are very prone to recur. Complete removal of the diseased part of the tongue is strongly advised, but, failing the possibility of thorough extirpation, it is best to rely upon the soothing influence of Morphia and Iodoform rather than to make use of astringents, which only tend eventually to aggravate the sore. Some relief may be given by removal of rough teeth or other sources of local irritation, but attempts to destroy the tissues with the cautery are not approved. Cases are, however, on record in which scraping and the subsequent use of the cautery or of Lactic Acid, etc., have been of decided relief to the patient, although in the long run the disease has ultimately re-asserted itself and led to a fatal termination. How completely the disease may be checked by timely excision is shown by a case recorded by W. T. Bull ("New York Medical Record," January, 1889), in which the whole tongue was removed for a large tuberculous ulcer at the back, of six months' standing. No tubercle was present elsewhere in the body, and the patient made an excellent recovery, and was able to resume his ordinary habits of life.

It is not too much to say that a tubercular ulcer of the tongue which is left untreated, or is only treated with mild astringents, is as certainly disastrous in its results as is the same condition in the larynx.

Tubercular ulceration may show itself in various parts

of the mouth, but is most frequently seen on the soft palate and uvula. The ulceration is usually very superficial at first, and may be seen to be formed by confluence of tiny tubercular nodules, which undergo disintegration close to one another and are finally merged in a single ulcer. As in the case of the tongue, these tubercular deposits have been from time to time proved to be primary in a few instances, with no evidence of similar disease elsewhere. A series of 14 cases, reported from the St. Rochus Hospital in Warsaw (where many investigations as to the local cure of tubercular ulceration have been carried on), tend to prove that the lymphatic glands are generally affected, and that vigorous scraping of the ulcers, followed by the application of lactic acid, may in some cases bring about a sound cicatrization of the affected tissues. The ulcers were only productive of fœtor in a few instances. The majority of these cases occurred between the ages of 22 and 30, but a few had attained greater age, the oldest being 54. In all of them the soft palate was affected. The uvula was attacked in ten cases, the tonsils in six, the posterior pharyngeal wall in six, and the tongue and lips in eight cases.

The tonsils have often been shown to be affected with tubercular infiltration of the crypts without manifest ulceration on the surface; hence the fact that they are tuberculous may easily be overlooked. Tubercular changes may advance, even to slight cavitation within the tonsil, without giving rise to such superficial changes as may be recognized as tubercular. The lingual glands are generally affected sooner or later, and are more easily detected. As in the case of the tongue, so with respect to the tonsils, if tubercular disease can be proved (and in the case of the tonsil it is very easy to squeeze out some material from the crypts, which can be stained for

bacilli), removal of the affected part should be done unhesitatingly, if the patient be in a condition to stand a surgical operation.

In dealing with cases in which only palliative measures can be adopted it is necessary to clean the surface of the ulcers before applying the soothing remedies. This can best be done by means of a little mop of cotton wool on the end of a probe, dipped in a solution of Boracic Acid (20 grains to the ounce), which may be used with some degree of force to clear off the adherent epithelial and inflammatory *débris* from the surface. If painful to the touch a solution of Cocaine (six to ten per cent.) may be first applied, and may be repeated when the surface has been thoroughly cleansed. Iodoform and Morphia in like manner may be applied in the form of fine powder, blown on to the cleansed surface with an insufflator, but it is rarely of any avail to apply such remedies to an ulcer the surface of which consists of a thick layer of coagulated albuminous material. Nitrate of Silver and other astringents are worse than useless if applied directly to the surface of a tubercular ulcer. Only after the tuberculous tissue has been thoroughly scraped away is it of the least use to employ astringents, and even then it is probable that equally good results would be obtained by simple cleansing with Carbolic Acid (one in 80), or Perchloride lotion (one in 1,000), with a mop of cotton wool. Such good results have of late years been obtained by the local application of Lactic Acid, varying in strength from fifty per cent. to the pure acid, that it should always be given a trial, but it should be applied vigorously after thorough cleansing of the surface of the ulcer.

Œsophagus.—Affections of the œsophagus are rare as complications of phthisis, but they are not unknown. Perhaps the most frequent cause of actual tubercular

disease in this part is direct extension from a tuberculous gland in immediate relation with it. Many instances are on record, not only of extension of tubercular deposit, but of rupture of a disintegrating gland into the œsophagus or into the trachea, and sometimes into both simultaneously. Such an occurrence is not of necessity fatal at once, but may give rise to extensive ulceration of the tube, and consequent dysphagia and vomiting. An instance has recently been published of œsophageal stricture following healed tubercular ulceration. Tubercular deposits in the mucous and submucous tissues have been described, but they are of extreme rarity, and still less often tubercular deposits have been found as a part of a general tuberculosis. From the point of view of diagnosis and treatment little can be said of these latter affections. From the fact that in the few cases in which they have been found their presence had been wholly unsuspected during life, it is obvious that they may be present without giving rise to symptoms, and hence without affording any indications for treatment. Only in the case of ulceration can it be said that diagnosis is possible, and even then the causation of such ulceration must remain a matter for conjecture, unless actual tubercular material or *débris* can be extracted for microscopic examination. Treatment in such cases must be determined by the general condition of the patient. Vomiting without pain, usually occurring directly after the ingestion of food, whether fluid or solid, is generally the most prominent symptom of œsophageal ulceration, and it has often been pointed out that this vomiting may be unusually violent, and that the ejected matters are often forced through the nose as well as through the mouth. The food is rejected unchanged, and without the sour taste that characterizes food which is returned after

a short rest in the stomach. The rapid regurgitation of food may lead to suspicion of stricture, and may suggest the passage of an œsophageal bougie, but such treatment is by no means advisable where the possibility of tubercular ulceration exists, owing to the danger of enlarging a perforation or an ulcer if the end of the bougie should become engaged in it. Rectal alimentation should be tried for a while, but cannot be maintained for long. The cautious swallowing of a mixture composed of 20 minims of Liquor Morphiæ, with glycerine and mucilage of acacia, will sometimes allay the immediate irritability of the œsophagus, and permit small quantities of milk to be swallowed in the course of the succeeding few minutes without pain and without regurgitation. The operation of gastrostomy remains as the only permanent means of administering food, but, insomuch as the œsophageal ulceration or perforation is generally a complication of the last stages of tubercular disease, such severe measures are but little likely to afford relief for long, even if they afford any relief at all.

Affections of the Larynx.—Of all complications of consumption, affections of the larynx are some of the most important. The frequency of their occurrence and the serious consequences that are almost certain to follow if actual tubercular disease becomes established and is allowed to invade the larynx unchecked, make the study of these complications and their treatment of the utmost importance to those who have much to do with the care of consumptive patients. Too often it happens that the hoarseness of voice, the altered tone of the cough, and the sensations referred to the larynx are passed over without examination, and without attempt at relief, until the laryngeal condition is past all hope of recovery. In the poorer classes of patients this course of events is very

common, and hence it is in hospital practice especially that the more advanced conditions of tubercular laryngitis are met with. It happens not unfrequently that a larynx having thus drifted from bad to worse, when it is examined for the first time in a hospital presents appearances such as the following :—The epiglottis swelled, superficially ulcerated, bathed in mucus and pus; the arytænoid cartilages one or both in a similar condition; the ventricular bands infiltrated; the vocal cords reddened, swelled, and often ulcerated, while their movement is obstructed by the local swelling. The unlucky patients are unable to swallow without constant pain, and unable to breathe freely without continued efforts to rid themselves of the accumulations of muco-pus, which seem to threaten complete obstruction of the already constricted air passage. We are able to do but little in the way of relief, and still less in the way of cure, for such conditions as these. But the questions must naturally occur to every one : What were the early stages by which such a miserable state of things was arrived at? Would it not have been possible to check the further progress of these earlier stages if the attempt had been made in time?

To answer these questions, clinical rather than pathological evidence must be sought. Clinical experience teaches that persons who are the subject of tubercular disease of the lungs are prone to suffer from a vast variety of morbid conditions of the larynx, but that these conditions are not of necessity of tubercular nature from their first onset. Many of them are just as capable of relief and cure in the persons of consumptive patients as in healthy persons; but there is abundant evidence to show that if neglected these early conditions are very liable to be followed by definite tubercular lesions. It is,

indeed, remarkable that so many sufferers from tubercular disease of the lungs should escape laryngeal complications, since almost all are subject to conditions which would seem to render the larynx at all times liable to inflammatory changes, if not to actual tubercular infection. The irritative cough, sometimes continuing for many months with only periodical remissions of a few hours' duration, the constant accumulation of secretion in the process of expectoration, and the frequent presence in it of active bacilli, decomposing material and septic organisms, all combine to tax the powers of resistance of the laryngeal mucous membrane to the utmost, more especially if there be any breach of its surface. Notwithstanding all these adverse conditions, it is a common observation that the larynx in a fair proportion of cases does actually remain unscathed even to the very last. Thus it was found that in the post-mortem examinations of cases of phthisis during the year 1888 no less than 30 per cent. of the inspections proved the larynx to be healthy. In the following years (1889-90-91) the proportion of the unaffected cases was still higher. Of 150 inspections morbid laryngeal conditions are reported in only 51 instances. If we turn for information on this point to clinical records we find the proportion of unaffected cases smaller, as so many conditions are therein comprised which are temporary or susceptible of complete recovery. A series of 100 cases of phthisis, published by Dr. Ormerod in "St. Bartholomew's Hospital Reports," in which the larynx was carefully and repeatedly examined in out-patient practice, whether symptoms of laryngeal disease were present or not, proved that the larynx was found healthy in 25 per cent. of the cases. In a similar series collected in the same way by Mackenzie at the London Hospital, the larynx was found to be

normal in 29 per cent. Later statistics, however, go to prove that laryngeal affections of one kind or another are more frequently met with than they used to be. Gottstein, for instance, places the percentage of unaffected cases as low as 2·6 per cent. Our own experience, gathered largely from many years' out-patient practice, does not quite agree with this; but we should be disposed to place the proportion of unaffected cases at about from 15 to 20 per cent. Of the affected cases the conditions met with are very varied, and bear no sort of relation to the extent or progress of the concomitant disease of the lungs, except in the latest stages, and hence they should be regarded as local affections and treated as such.

The question has very frequently been debated whether tubercular disease may occur primarily in the larynx. A few cases are on record in which the most careful search after death has failed to detect the presence of tubercle elsewhere in the body, and such cases prove at least the possibility of the condition. They are, however, very few in number. Many cases, on the other hand, are recorded, and are now frequently observed without special record, in which the disease in the larynx is the only discoverable focus of tubercle in the body during life. Although a strong presumption must always exist that tubercle must be latent in other parts also, the laryngeal condition must for all practical purposes be looked upon as the essential active lesion, even if it be not the only nidus of tubercular disease in the body. Such cases are, as a rule, the most amenable to treatment if only that treatment be applied in the earlier stages of the affection.

The symptoms of laryngeal disease, whether in tubercular or non-tubercular persons, are insufficient in themselves for diagnostic purposes. Where symptoms of

laryngeal disorder are present it is by laryngoscopic examination alone that we can tell the actual condition of the larynx. It is just as impossible to be sure of the condition of the larynx by the aid of general symptoms as it is to estimate the degree and extent of disease in the lungs without the aid of physical examination. Before the introduction of cocain it was often difficult and sometimes impossible to see into the larynx of the consumptive patient, but at the present time the preliminary use of a spray of six or ten per cent. solution of cocain will render examination possible in almost every case. In considering the various morbid conditions which may thus be seen by the laryngoscope in consumptive persons, a very large field is open for investigation in the voluminous clinical records of the past five years. Without unduly multiplying statistics we have taken 200 cases at random, some from hospital records, some from private notes, and some from the published records of other observers, and amongst those it may be fairly assumed that most of the ordinary affections will be included. (These cases comprise 130 males and 70 females. Eighty-seven of the males were between the ages of 20 and 40 years, eleven under 20, and twenty-one over 40. Of the female cases there were fifty-seven between 20 and 40, six under 20, and seven over 40.) Of the morbid changes illustrated by these cases we may first consider the conditions, general or localized, which are produced by disturbance of normal vascular supply—anæmia, hyperæmia, congestion, and hæmorrhage.

The condition of *anæmia*, and *especially localized anæmia*, of the larynx is held by some laryngologists to be a pretubercular condition, heralding the approach, though not declaring the presence, of tubercular disease of the lung or larynx. By other authorities the anæmia is only

looked upon as a part of a general anæmia, and, as such, not peculiar to consumptives. Most observers have noted that anæmia of the larynx is often accompanied by disturbance of the normal sensitiveness, being sometimes associated with anæsthesia and sometimes with hyperæsthesia or actual pain in the larynx, with tickling cough and marked susceptibility to changes of air. The explanations of this clinical fact have been various and conflicting, and we will not add to the confusion by any speculations of our own. The fact however remains that, apart from conditions of general anæmia, a large proportion of our cases of tubercular disease of the lung present a very striking condition of partial anæmia of the larynx.

The appearances seen in the laryngeal mirror have been often very remarkable and wholly unexpected. The anæmic condition is often very limited in extent, being sometimes confined to the epiglottis and sometimes to other parts of the larynx on one or both sides. Less characteristic, but at the same time more often seen in tubercular disease than in any other, is anæmia of the soft palate and the back of the pharynx. This is not an absolute pallor of the whole surface as is usually the case with general anæmia, but it is an anæmia of the background, as it were, with narrow injected vessels coursing in it. In a few instances these vessels may be seen to be slightly varicose. But even without this anæmic condition of the soft palate the pallor of the epiglottis is often marked, especially when the parts above appear to be normal. The presence and the degree of anæmia bear no relation to the extent or the stage of the disease in the lung. It is relatively as frequent in the confirmed or even advanced stages of phthisis as in the earlier stages.

Neither the age nor the sex of the patient appears to

have anything to do with it. It must not be forgotten that the use of cocaine will sometimes bring about a pallid condition of the mucous membrane, and hence observations after the use of cocain are not trustworthy. Another special localization of anæmia in tubercular cases is to the ventricular bands. Of 59 cases of affections of the ventricular bands, anæmia of one or both is recorded in our series of cases in 21 instances, but of these by far the larger proportion were associated with only slight affections of the lungs, although a few occurred with more advanced pulmonary changes. An anæmic appearance of the ventricular bands is not unfrequently set up in the act of phonation. The laryngeal movements in ordinary phonation differ considerably in different individuals, and the ventricular bands are moved much more in some cases than in others. Sometimes it may be noted that the latter are drawn towards the middle line in the act of phonation, and are at the same moment rendered anæmic, much in the same way as the tongue is rendered anæmic if it be protruded between compressed lips or teeth. Hence if any anæmia is found the observation should be repeated several times to make sure that the anæmic condition is permanent.

Hyperæmia of the laryngeal mucous membrane, by which term we would imply simple redness of the surface without swelling, may be either general or local. The whole of the larynx may appear simply reddened as a result of over-exertion in speaking or singing, but there is nothing to distinguish the condition in the tubercular or non-tubercular subject respectively. It is not always easy, however, to say with certainty that a condition of general redness is simple and uncomplicated by swelling. Hence simple hyperæmia from over-exertion may easily be mistaken for a general catarrhal condition, and the

converse. The history and concomitant symptoms will generally serve to guide the diagnosis.

Partial hyperæmia, on the other hand, occurs much more frequently in tubercular than in non-tubercular patients. Many, otherwise healthy patients, who are prone to be attacked by hoarseness and partial aphonia with a tickling laryngeal cough, will be found on examination to present a condition of patchy hyperæmia generally limited to the inter-arytænoid fold or to one or both vocal cords. Sometimes this hyperæmia is associated with a similarly limited affection of the soft palate. In many such cases a careful investigation of the history of the patient will be found to indicate a definite tubercular susceptibility, either inherited or acquired. The appearance of these hyperæmic patches and their association with a greater or lesser degree of febrile disturbance render it extremely probable that they are, in fact, produced by local inoculation and temporary activity of septic or tubercular micro-organisms. Many of these patches subside after a course of treatment within a few days, while others remain, and may even be followed by superficial erosion and ulceration, taking on an appearance characteristic of tubercular disease. It is to be feared that this early condition is one of the starting points of laryngeal tubercle which are most commonly neglected. By means of simple treatment these hyperæmic patches can often be brought back to a healthy condition if they are seen early enough, but when they have passed out of the simple hyperæmic stage they are far more resistent to local and general treatment. Patchy hyperæmia may often be seen in association with the local anæmia, to which we have already referred, and in such an association the suspicion of tubercular disease is all the more justified.

Congestion of the larynx, causing a general redness with a moderate degree of swelling, may be met with in connection with many morbid conditions, and especially with chronic renal disease, but, as in the case of anæmia and hyperæmia, it is the condition of *localized* congestion that is most often met with in association with tubercular disease or with syphilis, and it is exceedingly difficult to tell from the laryngoscopic appearances alone whether one or the other cause is at work. The history and other features of the individual case must be taken into consideration.

Hæmorrhage from the larynx is very rarely met with, except in association with deep ulceration. In tubercular disease, even though the ulceration be deep and destructive, bleeding hardly ever happens. In this respect the laryngeal tubercular ulcer resembles the allied condition in the intestine, with which it is very frequently associated.

Injected vessels, some of them slightly varicose, may often be seen in the pallid mucous membrane of the tubercular larynx, and enlarged veins at the base of the tongue are very commonly seen, but evidence of their being ruptured and causing hæmorrhage is entirely wanting. Patients from time to time present themselves who state that they have undergone an operation because of the enlarged veins at the back of the tongue. On questioning them, we have never been able to find that any marked relief has been afforded by the operative procedures, whatever they may have been. In one case only was it declared that the operation had cured hæmorrhage! In that case there was marked disease of both apices and a history of repeated hæmoptysis. There had been no recurrence since the operation, and the patient had been led to believe that his liability to

bleeding was cured. Such operations do not seem to us to be in any way justifiable, and when performed with the object of deceiving the patient as to the true source of his hæmorrhage must be characterized as both fraudulent and cruel.

If, as we have shown, the manifestations of laryngeal irritation in the presence of tubercular disease are, for the most part, unilateral and limited, it follows that some definite and local cause must be looked to to explain the fact. Although opinions may differ as to the relative frequency of infection with tubercular disease by the air and food passages respectively, there can be but little doubt that a considerable quantity of tuberculized dust must be inhaled through the larynx, and there is absolute certainty that a large amount of tubercular sputum containing active bacilli passes out through the larynx. There is thus a liability to inoculation by tubercular bacilli in both directions. Are the conditions of partial anæmia, limited hyperæmia, and localized inflammation in themselves evidence of inoculation by tubercular virus? We shall proceed to show that the graver tubercular lesions are, in like manner, limited and localized, and it would seem highly probable that the first set of changes are in reality the incipient conditions of the second. Whether the early localized anæmia is a pretubercular condition, not of necessity indicating the presence of tubercular disease, it is not possible to say. We should prefer to regard it much in the same light as we look upon the ovoid face, the long straight hair, and the other peculiar physical conformations which are commonly said to imply the "consumptive tendency."

Simple Inflammation, Acute or Chronic Laryngitis.—The larynx in tubercular persons may be affected by a simple general inflammation, which, if neglected, may

pass on into the chronic stage. Such cases do not differ in their laryngoscopic appearance from those of chronic laryngitis in non-tubercular persons, and hence must be regarded as non-specific and treated in the usual way, viz., by local astringents, whether the patient be the subject of tubercular disease or not. Common acute or chronic laryngitis may attack a whole larynx, parts of which are the subject of tubercular infiltration. By the use of ordinary astringents, the simple inflammatory condition may be subdued, but the specific lesion may remain unaffected. Tubercular infiltration may remain quiescent in the larynx, just as it does in the lungs, for long periods without any marked change taking place, and hence any intercurrent attack of inflammation should be treated as soon as diagnosed, in order to minimize, as far as possible, the risks of rekindling the activity of the latent tubercle.

It is, however, exceedingly difficult in some cases to tell the difference between a common catarrhal laryngitis in a tubercular person and a catarrhal laryngitis set up by tuberculosis of the larynx. The test of bacilli in the sputum is untrustworthy for diagnostic purposes. The bacilli if present may have come from the lungs, and if absent do not prove the absence of tubercular infiltration, so long as no disintegration is taking place. Occasionally a definite starting point of acute inflammation may be seen, especially on the epiglottis or arytænoid mucous membrane. A tiny patch of redness, a little œdematous swelling around it, and a minute whitish spot in the centre may often be seen in the course of laryngoscopic examination, although no symptoms may have indicated its presence. Such a focus of inflammation, if it be neglected, may be seen to spread, the surrounding tissue to become œdematous and swelled, while the little central

spot breaks down into a superficial ulcer. Yet another form of local tubercular infiltration is occasionally to be met with on the epiglottis in the shape of localized swellings, without much inflammation around them and with no breach of surface. So long as the surface remains intact local treatment would not appear to influence them. While general nutrition is preserved they may gradually subside. Perhaps the commonest of all forms of laryngeal disease in association with tubercle is swelling, limited to parts of one or both sides, but especially swelling of the epiglottis, arytænoid cartilages and ary-epiglottic folds. These may present the well-known turban or "sausage-shaped" form, and may or may not be associated with superficial ulceration.

These localized œdematous swellings are of particular interest, because they are rarely seen except in association with tubercular or lupoid disease. Their appearance may, therefore, be held to warrant a strong suspicion, if not a positive diagnosis of tubercle. Too often they constitute the first stages of a steadily progressive disease which resists treatment, and ultimately ends the patient's life after a longer or shorter period of suffering. In most cases, however, these swellings, if they be recognized early enough, can be brought to subside and sometimes to remain quiescent for months or years. If only a slight amount of tubercular infiltration has gone on, they may subside entirely, leaving no trace of their presence behind them.

They may arise in association with indications of fresh and active disease in the lungs, or they may give evidence of laryngeal implication only, but in either case they are frequently accompanied by a rise of temperature and other symptoms of slight systemic poisoning.

Sometimes the surface of the swelling is smooth, bluish

and shiny, while at others it may appear red and granulated, and on closer inspection with a good light, may be seen to be studded with minute superficial white points. When these latter are present there is usually more or less breach of surface, and sometimes the whole of the swelled parts are so much bathed in muco-pus that the surface cannot be seen till this has been cleared off. Upon the condition of the surface of the swelled epiglottis or arytænoid cartilage depend the symptoms produced by the disease. When the surface is unbroken there is usually but little pain and no dysphagia or dyspnœa, unless the swelling be large enough to produce mechanical interference with phonation or deglutition. If it be ulcerated, and especially if the broken surface appears red and irritable, the symptoms of dysphagia are generally well marked. Occasionally, when the swelling and ulceration are limited to the laryngeal side of the arytænoid cartilages, dysphagia is not complained of, unless actual perichondritis be present, but the more the ulceration extends to the œsophageal surface of the arytænoid cartilages the more intense is the difficulty of swallowing.

The simple pale swelling is not usually accompanied by much impairment of movement of the vocal cord. Where the swelling is red and angry-looking, and where there is decided impairment of movement, it is probable that perichondritis has been set up, probably as a result of a deep ulcer on the processus vocalis, which may be hidden from view by the swelling. Lastly, the swelling of the epiglottis and ary-epiglottic folds and the arytænoid mucous membrane may be uniformly ulcerated, and for the most part bathed in muco-pus. This is generally very difficult to remove, and may sometimes almost require to be scraped off, leaving behind it a finely

granular, raw, but rarely bleeding, surface. The *débris* thus removed will be found on microscopic examination to contain a large variety of buccal micro-organisms, and probably a good deal of disintegrating tubercular tissue and tubercle bacilli. This condition is usually seen in the final stage of the lung disease, and is followed by the fatal ending within a few weeks, but cases are sometimes met with in which this widespread ulceration has occurred in patients who have only limited disease in the lungs, and in whom a good deal of recuperative power still remains.

Ulceration.—In most cases of tubercular affection of the larynx, ulceration is present sooner or later. It may occur at any point in the larynx, and is not always accompanied by much swelling. A very common seat of tubercular ulceration is the processus vocalis of the arytænoid cartilage on one or both sides. These ulcers, in their early stages, although probably of tubercular origin, may often be rapidly healed by astringent applications, but, like other tubercular lesions in the larynx, when once they have become chronic, or surrounded by much thickening of inflammatory tissue, they are exceedingly resistant to all forms of local application. The inter-arytænoid mucous membrane is another favourite seat of tubercular erosion, and is often the cause of a tickling and troublesome cough, associated with a good deal of soreness on coughing. It is at this point especially that the mucous membrane is thrown into folds with every excursion of the vocal cords, and hence the part is seldom at rest for long together. Pulmonary secretions, if they be not forcibly ejected, are also apt to cling about the roughened surface and so to increase the risk of inoculation by specific bacilli.

Ulceration may spread along the vocal cord from the

processus vocalis, and is then liable to produce a longitudinal fissure of the cord, which has been held to be very characteristic of tubercle. It is, as a rule, only met with when the disease is far advanced, and when the possibilities of healing have become remote.

A careful distinction must be made between those forms of ulceration which occur on surfaces which are otherwise healthy, and those which are formed on surfaces which are already infiltrated in their deeper layers by tubercular tissue.

Non-specific ulceration, like simple inflammation, may be present in a tuberculous larynx, and is capable of healing rapidly if kept clean and stimulated, but such ulcers are exceedingly likely to become infected with tubercle unless they are treated shortly after their formation. Tubercular ulceration is often found to be complicated with a great deal of surrounding induration, and where this is the case the possibility must be borne in mind that the case may be syphilitic as well as tubercular. This induration may lead to considerable puckering of the mucous membrane, giving in some cases the appearance of tumour and even partially obstructing the view of the larynx or causing impairment of movement of the vocal cords. The condition which has been described as Pacchydermia laryngis, which in its ordinary form consists of a small outgrowth from one processus vocalis, corresponding with a similar but smaller excavated outgrowth from its fellow, may in its early stages be erroneously regarded as tubercular. It is, however, very resistant to local treatment, and runs a very chronic course without extension to other parts of the larynx, and causes hardly any symptoms beyond those of hoarseness. In like manner the very early stages of carcinoma of the larynx may simulate an early tubercular condition, but as

a rule they interfere much more definitely with the movements of the cord on the affected side.

Complete obstruction to the larynx, either by the soft and œdematous swellings, or by the gradual encroachment of the chronic thickenings to which we have referred, is not often brought to such a degree as to necessitate tracheotomy. If such necessity does arise it is usually brought about by the chronic rather than by the acute process, except in the rare instances where sudden œdema takes place.

Localized tumours are occasionally met with in the larynx, springing from the ventricular bands, the inter-arytænoid fold, or from the processus vocalis. They have generally been found to consist mainly of aggregated tubercular nodules which are undergoing process of organization, and are held in an irregular meshwork of fibroid tissue. Such tumours may remain unchanged for months or years, and either gradually shrink if the process of organization is active, or may break down and disintegrate, leaving an irregular ulcer behind. They usually occur in the first instance in association with a limited lesion in the lung, which also undergoes a process of organization. The process seen in the larynx is indeed identical with that which is in progress in the corresponding lesion within the lung.

The free movements of the vocal cords are frequently interfered with when tubercular or even simple inflammatory lesions are present in the larynx. They may roughly be classified as paralytic and mechanical, although these causes are frequently combined.

Paralytic impairment of movement may be temporary or permanent. Patients differ widely in the extent to which their nervous apparatus is affected by any inflammatory or mechanical cause. Thus a very

slight catarrh of one vocal cord may be sufficient in one patient to produce almost complete paresis of the thyro-arytænoid muscle, while in another it will hardly be affected. Even in the same patient it will be found that on one occasion movements may be almost suspended while on a second examination the cords may be seen to move freely. Hence in early cases it is advisable to examine the larynx at intervals before deciding that a definite paralysis is present. These temporary forms of paralysis generally affect the movements of adduction. Where the paralysis is due to any central or peripheral disturbance of the nerve currents outside the larynx, as by pressure or other interference with the recurrent laryngeal nerves, the loss of movement, as conclusively proved by Dr. Felix Semon and others, always affects the movements of abduction in the first instance. Mechanical impairments of movement may be either produced by actual swelling or by affections of the crico-arytænoid joint on one or both sides. This latter condition would always suggest the possibility of syphilis as an element in the case. Whether arising from mechanical or other causes, defective movements are of serious importance in the progress of the case. Not only causing impairment of voice, which is in itself of minor importance, the inability to bring the vocal cords together prevents the complete act of coughing, and hence the patient is unable to clear his larynx of the sticky infective and adhesive muco-pus which hangs about it, and thus the tendency for the tubercular process to spread superficially is greatly assisted.

In dealing with the *treatment* of tubercular affections of the larynx, the nature of the disease as a whole must always be borne in mind. As with the disease in the lungs, so with the disease in the larynx, the

primary object must be to place the patient in the best possible hygienic surroundings, to regulate his natural functions by appropriate means, and to maintain the highest possible degree of nutrition. After these the local conditions must be looked to. Above all other considerations in dealing with such conditions comes the question of cleanliness. We have already made mention of the extremely sticky and adherent nature of much of the secretion, and it will easily be understood how important it is to keep the larynx as free as possible from the presence of such material, which can only serve as a storehouse and perhaps as an incubator for countless micro-organisms. It happens occasionally that small patches of secretion work themselves into positions within the larynx, from which they cannot be dislodged by the ordinary process of coughing and "clearing the throat," but may remain for a long time, causing great local irritation. Hence it is of the highest importance to free the larynx of all such secretion by means of a brush or cotton-wool mop if the patient is unable to keep it clear by natural means. Natural efforts may sometimes be aided by the systematic inhalation of steam, either plain or medicated, with a little Tincture of Benzoin or even by simple stimulant inhalations at the ordinary temperature, such as the vapour of Pinol. In a considerable proportion of the cases, however, direct intra-laryngeal treatment is necessary. The introduction of cocaine has overcome one of the chief bars to its use, viz., the sensitiveness of the fauces; but even with its aid intra-laryngeal treatment is not always easy to carry out. Much depends upon the formation of the pharynx and the position of the epiglottis. The former may be very narrow, and the latter, even if not diseased, may hang backwards to such an extent as nearly to touch

the posterior wall of the pharynx, even during forced phonation. Or, again, being diseased, it may be so fixed or so much swelled as to obstruct the upper laryngeal opening. Under these conditions it is only possible to get a very restricted view of the larynx, and hence the introduction of any instrument should not be attempted.

As a general rule, no intra-laryngeal applications should be made unless a good view of the larynx has previously been obtained. The use of local astringents or caustics should not be undertaken without careful consideration, as evidence has repeatedly shown that, while they often do great good, they sometimes do great harm. Simpler methods of local treatment are often equally effective, provided that the internal surface of the larynx is kept clean and free from irritants.

The early conditions of anæmia do not call for any local treatment, but they should be carefully considered in relation to the other evidences of tubercular disease which the patient may present, and even if these are but slight the laryngeal condition would warrant us in regarding the patient as susceptible to tubercular disease, and therefore to be treated in the same careful manner as regards climate and general hygiene as in the case of incipient or threatened disease in the lungs. Care only must be exercised to be sure that the laryngeal anæmia is in itself a special condition, and not merely a part of a general anæmia.

Hyperæmic conditions, on the other hand, require careful local treatment. A general redness, usually associated with more or less catarrh, can best be treated by complete rest to the voice and inhalations of steam, medicated with compound Tincture of Benzoin (one drachm of the tincture shaken up in a pint of water at about 160° F.), at intervals of four hours, the patient remaining as much as

possible in one room, and certainly in the house, until the more active stage is over. If these measures do not succeed in restoring the larynx to its natural condition, and if the hyperæmia continue, more stimulant inhalations may be tried, but as a rule it is more effective to make direct application of stimulant solutions to the larynx by means of a brush or cotton-wool mop. (Sulphate or Chloride of Zinc or Perchloride of Iron, 20 grains to the ounce, will generally suffice for the purpose). In the cases of localized hyperæmia, whether the hyperæmic spot be upon the epiglottis or the arytænoid cartilage or inter-arytænoid space, direct application of astringents is advisable. Sometimes the simple application of a strong (20 per cent.) solution of Cocaine will put a stop to the local irritative process, and may safely be tried in the first instance. The simple astringents referred to above may here again be applied, or if there be any appearances indicative of a tubercular deposit about the hyperæmic patch, the use of a 50 per cent. solution of Lactic Acid is advisable, but in each case the solution should be applied to the hyperæmic patch only if possible.

By energetic treatment of these early conditions a good deal of subsequent laryngeal mischief may be avoided, but if no results are obtained, as is sometimes the case, or if the patch develops into an ulcer which shows no sign of healing, but rather tends to spread, then astringent treatment should be suspended, and cleansing and soothing applications should be made, than which there is nothing better than a powder composed of Iodoform or Iodol (gr. i.), Boracic Acid (grs. ii.), and Hydrochlorate of Morphia (gr. $\frac{1}{4}$). This may be blown into the larynx by means of an insufflator twice in the day.

General hyperæmia may sometimes be seen, especially in voice-users, accompanied by a good deal of soreness in

the larynx and hoarseness, and frequently a little tenderness on external palpation. Such cases have sometimes been rapidly improved by the direct application of cold to the larynx. The patient may be directed to suck small pieces of ice at intervals throughout the day, and at the same time to apply to the larynx externally some pounded ice and salt, wrapped up in a few layers of flannel so as to fit closely round the front and sides of the apple of the throat. This method is, however, only effective when the degree of redness is very intense.

For the treatment of ulceration in the larynx, when that ulceration is obviously due to tubercular disease, no hard and fast rules can be laid down, unless it be the one which applies to ulceration in any part, viz., *cleanliness*. This is far less easy to attain in the larynx than elsewhere, but it is generally attainable to a very considerable extent. As regards the local application of astringents to ulcers, we must be guided a good deal by the general condition of the patient. If he appears to have plenty of recuperative power, and if the ulceration seems to be in an indolent condition, then stimulation of the surface is desirable and useful. If, on the other hand, the margins of the ulcers appear red and angry and with shreddy outline, it is usually better to refrain from direct stimulation and make use only of sedative and cleansing applications, using iodoform and morphia as previously stated.

Europhen has been recommended as a substitute for iodoform in cases of ulceration of mucous membranes. It possesses equal cleansing powers, but is less likely to produce toxic symptoms and is free from the pungent smell. It is not soluble in water or glycerine, but may be used in the form of powder or dissolved in alcohol.

Removal of dried secretions that may be adherent in any part of the larynx is very essential, and this may

best be done by steam inhalations of solution of carbolic acid of five per cent. strength, or by the direct application of a weaker solution by means of mop or brush.

It ought to be very clearly recognized, but at the present time it is not sufficiently acted upon, that ulceration within the larynx, if it is to be dealt with successfully, must be dealt with frequently. The occasional application of astringent or other remedies at irregular intervals, although it is better than no treatment at all, is neither a satisfactory nor a reasonable method of dealing with such conditions. The larynx should be examined at least once daily, and should be cleansed of any adherent mucus which may have collected at some point where the act of coughing is not sufficient to eject it. The frequency with which astringent applications should be repeated must, of course, differ widely in individual cases and according to the amount of reaction which may have followed the previous applications.

Of the many drugs that have from time to time been put forward as exercising some sort of specific action upon tubercular tissue, Menthol has met with a good deal of praise. Although there is no evidence to show that it has any specific action, it undoubtedly "does good" to the milder forms of tubercular ulceration. It possesses slightly antiseptic and cleansing properties, and is, at the same time, a local anæsthetic. It is not easily soluble in water, and must, therefore, be dissolved in olive oil, oleic acid, or some other oily substance. It can best be applied with the ordinary laryngeal brush or cotton wool mop in 15 or 20 per cent. solution in olive oil.

Patients to whom it is applied for the first time should be warned that it produces a somewhat suffocative sensation for the first few moments.

Rosorcin, which has frequently been tried in these

cases, has but little to recommend it, and when applied in the throat is not unlikely to produce slight toxic symptoms.

The use of Lactic Acid as an application to tubercular ulceration has become so universal of late years that it has almost come to be regarded as a specific remedy for tubercle. It must be noted, however, that the best results are reported by those who have been permitted to use the acid for long periods. Excellent results have been reported from Warsaw and elsewhere, telling of many hundred applications to the same patient. It is to be feared that such wholesale faith and patience is rarely to be met amongst British patients and hence the records of success in this country are by no means numerous. One essential point in the use of lactic acid is the necessity for perfect cleanliness of the surface of the ulcer to which it is applied, while there can be no doubt that its effect is more rapidly perceived when the surface of the ulcer has been scraped with a curette. This process, which is very easy to carry out in the upper parts, becomes much more difficult when the ulceration is seated in the lower levels of the larynx, and requires a skilled hand and much patience on the part of the surgeon, and no less patience and co-operation on the part of the patient. As a practical means of treatment, therefore, it is limited to those cases in which the larynx is easily entered, and in which the patient is willing to assist the surgeon and undertake to submit himself to treatment for considerable periods; and, above all, the general condition of the patient must be such that there is reasonable hope of good reaction after the irritation caused by the scraping and acid stimulation. Another point for serious consideration is the amount of probable tubercular infiltration that surrounds the ulcer. Where that infiltration is limited and

can be felt to be tough and firm, no good result is likely to be attained by attempting to scrape it. A process of limitation, if not of actual cicatrization, has probably begun, and cannot be assisted except by keeping the surface of the ulcer clean, or perhaps applying lactic acid to its surface without attempting to rub the acid into its deeper layers. In other cases where there is considerable swelling, and where the infiltrated tissue feels soft and boggy and presents no sign of organization, then, if the patient's general condition warrants it, the soft tissue should be scraped away and firm and vigorous application of lactic acid (50 per cent.) should be made. The patient must, as a rule, be kept from talking and from exposure to cold while this treatment is in progress, although in some few instances patients bear it with but little discomfort, and cannot be persuaded to make invalids of themselves.

Microscopic evidence goes to prove that tubercular affections of the laryngeal mucous membrane are, in many cases, at first superficial. Local treatment, therefore, if it be applied early enough, needs only to be superficial. The rapid effect of lactic acid upon early tubercular erosions on the tongue and pharynx or soft palate is sometimes remarkable, but such good results are rarely obtained when the disease is of long standing. Hence, we would urge the necessity for more systematic examination of the larynx in cases of tubercular disease whenever the slightest evidences are present of any laryngeal complication, in order that the early lesions may be checked while they still remain superficial.

The treatment of the common and characteristic œdematous swelling of the epiglottis and arytænoid cartilages requires careful consideration as it is apt to lead to disastrous consequences in the future if it be

neglected. In all cases where such swellings have appeared in a comparatively short period, they should be looked upon as evidences of the presence of active tubercular disease and treated accordingly. The patient should not be permitted to go about his ordinary business, but should be kept as far as possible in one atmosphere till the febrile symptoms, which in most cases are present, have subsided. The diet should be light, but not lowering, the free action of the bowels should be maintained, and the larynx treated locally by means of inhalations of mild astringents, atomized by Siegle's steam spray twice or thrice daily. By such means as these the œdema often subsides, and the condition becomes quiescent, but it has to be borne in mind that the deeper seated infiltration which was the cause of the œdema is not removed, although it ceases to be active.

The following formula has been found useful in many such cases :—

℞ Acid. Tannic., gr. xx.
Cocain. Hydrochlor., gr. xv.
Glycerini, ʒii.
Aquam ad ℥i.
To be inhaled in spray.

In some cases this line of treatment is insufficient. The swelling remains and may even threaten to obstruct the larynx to an unpleasant, if not to a dangerous extent, and as yet no very successful method of dealing with it has ever been devised. Of late years it has been proposed to inject such swellings with lactic acid by means of a perforated needle and syringe, but it cannot be said that any great measure of success has been achieved. Successful cases are, as a rule, recorded, and as these are so few it must be assumed that there are many unsuccessful cases which have remained unrecorded.

Another method of dealing with these cases of infiltration with only a moderate amount of ulceration is by the galvano-cautery. The thickened tissue may by this means be gradually destroyed, but success must obviously depend upon the amount of reparative power that the patient possesses. Cauterization causes a breach of surface, and unless the tissues are sufficiently well nourished an ulcer may be set up which may be more serious in its results than the original infiltration. Its advocates claim for it that less pain is produced than in the operation of scraping and applying lactic acid, that there is less bleeding and less danger of infection. On the other hand the use of the galvano-cautery is liable to set up a dangerous degree of œdema.

This infiltrating lesion, however, resembles in its course that of similar lesions in other tissues, and is apt to remain quiescent for long periods, and sometimes to subside gradually if the patient's health and strength be maintained. As the process is in all probability deep-seated in its origin it is hardly to be expected that the same good results of local treatment will be obtained as in the case where the tubercular process has been superficial from its first onset.

When the surface of these infiltrated swellings has broken down, the almost hopeless condition is arrived at to which we referred at the outset of this section. As a rule the patient's end is then approaching, and nothing more than palliative treatment is justifiable. To aid the process of swallowing by means of morphia or cocain, and to remove troublesome accumulations of secretion, must be the only aim of treatment under such conditions.

Dysphagia is often the most serious trouble. The constant use of a six per cent. solution of cocain applied to the pharynx and larynx with a brush, or more con-

veniently by means of a handball spray before each meal, will often enable the process of swallowing to be completed in comfort. In cases where the application in itself causes distress, much relief is often to be got by swallowing in sips before all meals a sticky mixture composed of hydrochlorate of morphia, gr. $\frac{1}{6}$, mucilage of acacia one drachm, and glycerine two drachms, with water to an ounce.

Gastric and Intestinal Complications.—Dyspepsia and Disorders of Digestion.—The stomach, like the œsophagus, is but rarely the seat of actual tubercular deposit or ulceration, but cases have been recorded from time to time in which such lesions have been found on autopsy. In some of these it has been possible to form a diagnosis during life, but in the majority the symptoms of the presence of such deposits or ulceration have been too much obscured by those of the tubercular disease of the lung for any suspicion of their existence to have been aroused. Indeed, in all cases the symptoms of such morbid states of the stomach in phthisis are not specially marked. Statistical information upon the percentage of gross lesions of the stomach found in a number of collected cases show that tubercular ulceration is very rare, probably less than one instance in a thousand cases. As regards other kinds of ulceration of the stomach we find, on reference to records of post-mortem examinations, that either recent or chronic ulcers are present in upwards of ten per cent. of all the cases, but as a rule such ulceration appears to be of the so-called follicular or small variety, or of a very superficial kind of abrasion of the gastric mucous membrane which scarcely deserves the name of ulcer. Chronic ulcers of the stomach, in many instances unconnected with the disease, have been noticed in about one per cent. of the post-mortem records. All of these

lesions, if accompanied by special symptoms, may possibly be recognized during life, but in the majority of cases they are those of aggravated dyspepsia only, the exciting cause of which is less considered than the plan of treatment which may relieve it.

We see, then, that there are no specific changes which occur in the gastric mucous membrane in tubercular disease except in exceedingly rare instances, yet we are confronted by the fact that almost every tubercular patient as a rule suffers from disordered digestion to a greater or lesser extent during some part of the course of his disease. This abrogation of the proper functions of digestion may be in a certain proportion of cases attributed to actual catarrh of the stomach, either acute or chronic, which is demonstrable in a certain proportion of cases upon post-mortem examination. Writers upon the subject are agreed that such catarrh is present, although there is a considerable difference of opinion as to the proportion of cases in which it can be made out. From our own observations we think the percentage which is given by the late Dr. Wilson Fox, viz., 62 per cent., very high, and the observations of others appear to be based upon the examination of too few cases to be very useful. Bearing upon this point, however, we think those of Dr. Soltau Fenwick are important.[1] In fifty cases (too few, of course, to be absolutely conclusive) he observed that the stomach and intestines were seldom affected except in those cases in which the tubercular material in the lungs had softened, or in which cavities had been formed in the lung. Thus out of 27 cases of such a condition 23 presented, on microscopical examination, signs of interstitial gastritis, six of parenchymatous gastritis, and eight of amyloid disease (some of the lesions in certain cases being com-

[1] "The Dyspepsia of Phthisis," 1894.

plete), whereas of 23 cases of more recent and less advanced disease of the lungs only five showed any signs of gastric lesion. It would seem, therefore, if it is allowable to generalize from these cases, that the gastric mucous membrane, which alone contains the secreting glands of the stomach, is generally affected with more or less inflammation, and sometimes with a cirrhosis, in the majority of cases of chronic phthisis, but in cases of earlier tubercle of the lung no such inflammation or obvious affection of the stomach can be discovered. In this connection we must bear in mind the fact that our autopsies are generally made upon tubercular subjects in very chronic and advanced conditions of the disease. Such chronic inflammation of the gastric mucous membrane, coupled with other demonstrable abnormalities of the digestive apparatus, may in such cases, and for some time, perhaps, before death, explain the dyspepsia, which, as we have seen, is so constant a possibility during the whole course of the disease. But it only explains dyspepsia in the late stages; it does not explain the dyspepsia which occurs in the early stages, nor does it account for the dyspepsia which *appears* to precede the deposition of tubercle in the lung tissue. We have to go farther in our inquiry into the cause of such phenomena. Let us first of all consider briefly the various digestive troubles which have been observed in connection with tubercular phthisis. Cases are sufficiently common in which, to all appearance, the tubercular affection of the lung is secondary to the dyspepsia. Under such circumstances it is possible that the dyspepsia produces such a condition of the organism that the attack of the bacillus is not successfully resisted, and that the tubercular disease may be considered as indirectly dependent upon the disorder of digestion, or, on the other hand, the tuber-

cular process may be present, but may not be easily recognized by the physical signs which usually give a clue to its whereabouts. We are inclined to think that both of these conditions occur. In the majority of cases it is probable that the tubercular processes are indeed present in their earliest stage, but are, as far as physical signs are concerned, latent, whilst in other cases the dyspepsia is so damaging to the general well-being that the body is potentially unable to offer sufficient resistance to the attack of the specific microbe. It is clear that the dyspepsia which occurs at this date may be continued for some time after the disease in the lung has declared itself unequivocally, and that the symptoms are very much the same before as after this event. It would, therefore, be difficult without straining differences to distinguish between the dyspepsia of the earlier disease and that which appears to occur before the disease has declared itself. At any rate, this differentiation is not sufficiently practical to be of service to us in the present case.

The dyspepsia which presents itself to our notice during this first period may be roughly classified as belonging to two types, corresponding, indeed, with the ordinary types of the affection, viz., the atonic or adynamic dyspepsia, and the painful, irritative, or nervous form. Of these, according to our experience, the latter is much more common than the former. In both there is pain after taking food more or less marked. In both there is a very capricious appetite, with most intense likes and dislikes for certain articles of food. This is, however, more marked in the nervous type of the affection. In both there is a tendency towards constipation, and almost always gradual loss of flesh. The main differences, however, which separate the two types are the following:—The first is more often observed in youngish anæmic

women about 20 years of age, whilst the second is chiefly to be met with among men at ages from 25 to 45. In the cases of the atonic variety the patient is usually very anæmic, listless, liable to faint, with large, pale, flabby tongue (often furred), having a great dislike to meat, and, as has been so often pointed out, to fat, particularly to fat of meat, and with liking for indigestible things.

When the patient is a woman the catamenia are generally irregular in time or amount, and, in fact, the whole of the bodily functions are more or less out of order. Sometimes the patient complains of pyrosis. All of these are simply indications of a form of chronic indigestion, and they are generally regarded as due to that and no more; but if a cough develops and the patient begins to spit, attention is drawn to the condition of the chest, and a physical examination is made, although at first it may happen that no physical signs of any lung infection are discovered. After some weeks, or possibly months, slight signs in the chest may be detected, and it is discovered that the dyspepsia is, or has been, cloaking graver mischief. Among out-patients at a Chest Hospital cases of this kind of preliminary indigestion are so common that few who have much experience are contented to pass by without careful examination those cases which superficial inquiry would classify as cases of "indigestion." As we have said, the instances of the second variety of pretubercular dyspepsia in our experience have been more numerous than the first; they are characterized by certain symptoms which are, from their frequency in connection therewith, exceedingly suggestive of consumption. Of these we may mention one or two. First, and most important, is the extreme craving for food, coupled with a feeling of exquisite nausea. The nausea is almost always relieved by the ingestion of a little food, and the

appetite is at once satisfied. The nausea is also combined with a peculiar feeling of weight at the pit of the stomach, although the tongue is usually red and clean, though sometimes glazed. The appetite is never good, and pain in the gastric region is constantly felt for long periods after food, and the patient often says he would be relieved by an emetic, and indeed not infrequently tries to make himself sick.

It is sometimes to be noted that articles of food of the most indigestible kind are those best tolerated; but fat can seldom be eaten. Less often there is a dislike for sweet things. Patients of this kind are often looked upon as hypochondriac, and their constant complaints, their irritability, their intense dislike to having their plans of life at all interfered with, make them anything but pleasant companions. For example, a patient will have afternoon tea at a certain fixed hour, generally early, say at four or half-past three. If the meal is at all delayed, even for only half-an-hour, he will not touch it; all of his appetite has departed without food. There are usually acid or bilious eructations, flatulence, fulness in the epigastrium, with more or less tenderness, and rumbling of the intestines. Coupled with these symptoms there may be harsh, dry, dark skin, or occasional night sweats, and, more significant than all, wasting. Time after time a patient with dyspepsia, such as we have described, is examined by percussion and auscultation, and no signs of implication of the lungs can be found until one day perhaps a deficient entry of air at some one spot and just a suspicion of crepitation after coughing are detected. From such a day onwards the steps of the disease are soon distinct enough, and the patient, whom his medical man has considered not a little troublesome, even if not hypochondriacal, is the subject of the well-developed disease. Of

course it is not suggested that this form of irritative dyspepsia is always an indication of tubercular mischief, but it is quite sufficiently often such an indication as to make a careful practitioner on his guard for the first evidence of the pulmonary disease.

The dyspepsia which occurs during the course of phthisis after the early stage does not present any peculiarity over the ordinary kinds. It inclines either towards the atonic form or to the irritative, is variable in amount and duration in each individual case. It is aggravated by high fever. The symptoms most commonly complained of are: pain, to a considerable extent constant, but increased by eating certain things, not always the most indigestible, often localized to one or more spots in the epigastric region, generally thought to be due to "pleurisy" in the side, often felt between the shoulders, but most often on the left side, not infrequently accompanied by tenderness over the painful area, nausea and vomiting more troublesome than in the early stage; acid eructations and flatulence; obstinate constipation alternating with diarrhœa, but, above all, almost complete anorexia. Milk, beef-tea, fish, chicken, and so on are all in turn refused, until the medical man is at his wits' end for new suggestions as to diet. In the late stages of the affection the dyspepsia becomes more and more pressing, and the power to digest appears to depart. It is true that pain is less often complained of, but then the sensibilities are generally to some extent dulled; vomiting is common until the power to vomit is lost, and then the food, in a state of fermentation, collects in the weak-walled stomach and dilatation is the result.

We have seen, then, that the dyspepsia occurring in the later stages of phthisis is explicable, since there is found after death, in a large proportion of such cases, an

anatomical substratum for disturbed digestive functions, not only in the mucous membrane of the stomach, but also in other digestive organs, such as the pancreas and the salivary glands, not to mention the liver, which is often in a fatty condition. In the early stages, both before and after the appearance of tubercular lesions in the lungs, it is exceedingly unlikely that any of the digestive organs are the subject of gross pathological processes. The dyspepsia in these cases, and to a less extent later on in the disease, must depend upon functional and not upon organic disorders.

With reference to these functional disturbances of the digestive organs the derangement of the nervous apparatus of secretion has an important bearing. There are scarcely any facts in the range of physiology so well established as those relating to the effect of the nervous system upon the secretion of saliva, and it is very probable that the nervous control of all the secretory glands is as intimate. It therefore follows that the amount and possibly the composition of the various digestive juices depend upon the nervous supply of the glands. The glandular secretions may be stimulated, altered, or inhibited by nervous influence. It is a perfectly well recognized phenomenon in healthy persons that any strong emotion, fear, grief, joy, excitement, or the like, may affect appetite and digestion in a very marked degree. A person oppressed with any mental worry may find that his food lies "like a lump of lead" upon his stomach, and that if the cause of this worry or abnormal feeling be removed the sensation passes away. Between the extreme degree of nervous sensations such as these and the ordinary nervous control exercised in the healthy man there are necessarily many gradations, and we can have no doubt that the varying hopes and fears, expectations, and disappointments to

which the phthisical patient is subject during the slow course of his malady must exercise some amount of influence, varying from day to day, over the regular course of his digestive processes.

In the early stage of tubercular disease, and also possibly in all cases in which there is acute mischief going on in the lung, we have to do with something perhaps more definite, in theory at all events. Under such circumstances it is probable that there is circulating in the blood the products or toxines of the tubercle bacilli. These toxines have been proved to be most virulent poisons. Bodies of such great power as nerve irritants, or stimulants, or as nerve paralyzers, may well be expected to exert their influence upon the nervous apparatus of digestion, either centrally or locally, or both centrally and locally, whereby a considerable alteration of the digestive secretions comes about. Again, even supposing the specific tubercular processes are at a standstill, but the established vomicæ in the lung tissue continue to pour out purulent secretion, we may have at the same time the absorption of the toxines of the pyogenic organisms, which may have a similar effect upon the nervous mechanism of secretion.

Such influences cannot be brushed aside as too theoretical for practical physicians. Under both conditions of affairs we have distinct proofs of the implication of the nervous system by poisoning; such we see in the pyrexia and the sweating, and sometimes the rigors, from which the patients suffer. We probably have a condition with respect to the stomach of what may be called apepsia, and the similar want of proper secretion is in all probability to be found with respect to the other digestive organs.

When we come, however, to examine into the immediate

cause of the symptoms from which patients in consumption suffer in connection with the digestive system, we are obliged to admit that they are due to the irritation produced by the accumulation of undigested food or of food which has not only not been digested in the stomach and intestines, but which has undergone fermentative changes, the result of which is above all others the formation of lactic and butyric, and possibly other fatty acids (*e.g.*, acetic and propionic). These fatty acids are not formed from fats, as the patients possibly imagine, but from carbohydrates, and especially from starchy food, such as bread and potatoes, and from sweets. No doubt we have to deal with another factor in the causation of all the unpleasant symptoms about which we have spoken, and that is a partial atony of the muscular walls of the stomach. This permits the accumulation of the undigested food and so renders possible the fermentation of the contents of the viscus.

In scarcely any stage or condition of the tubercular disease is the secretion of the stomach and of the other digestive glands absolutely abrogated. It has been clearly shown, for example, that it is possible to obtain pepsin of good quality from even the most cirrhosed gastric mucous membrane, and the same is the case, in all probability, with regard to the other digestive glands. It follows, therefore, that we have it in our power to considerably relieve the dyspepsia, even in the most advanced cases, since we have not to deal with a completely disorganized digestive apparatus, but with one which is weak and easily overstrained. We have to regulate the taking of food, and its preparation for digestion, to prevent the accumulation of undigested food, and we have to prevent fermentation within the stomach.

When dyspepsia occurs in tubercular children and in

young adults, pain after food and flatulence are usually the result of improper or of too rapid mastication or a too liberal supply of food. Children, as a rule, require educating up to the necessary amount of mastication which is required for a healthy digestion. The majority of children between the ages of four and eight are prone to eat too much, and to eat too quickly; they also invariably bolt their food. Many, if not most, however, do not appear to be any the worse for the habit, but the weakly and the tuberculous types are apt to suffer from "stomach-ache," headache, lassitude, and irregular action of the bowels, with clay-coloured stools; all of which symptoms may be ameliorated by careful insistence upon the ordinary rules of careful feeding. Slow and perfect mastication should be insisted on, and a due proportion of fluid to solid with each meal and the constant use of salt with all kinds of food which do not contain it. Of these, perhaps, slow and perfect mastication is the most important, and care should always be taken to find out whether the child is provided with proper masticatory apparatus. Defective teeth are often the cause of defective mastication, and the child bolts his food to save himself from the discomfort of biting with a tender tooth.

These errors are common to most children, and are corrected as years advance, but in the case of children in whom there is any hereditary taint of consumption, or who are prone to suffer from enlarged glands in the neck and elsewhere, it is a matter of no small importance, as bearing upon their future welfare, to see that they are early corrected. In tuberculous children, it should be recollected, the danger of tuberculous disease is not confined to the lung. The gradual wasting of a child whose food is said "to do him no good," and who yet presents

no definite sign of stomach disorder, is due in many cases to imperfect assimilation of food because of changes progressing slowly in the mesenteric glands. These chronic changes in their turn are to be attributed to the imperfect preparation of the food for absorption in the stomach and duodenum, and to the irritation produced by undigested food in the alimentary canal. It is this condition of wasting, without obvious sign of digestive disorder, that has come to be known by the uneducated classes as "consumption of the bowels," but as we see the defect is generally not so much in the intestines (except the upper part) as the stomach.

The Report of the Royal Commission on Tuberculosis has made it very clear that infection by means of milk may take place with extreme facility, and that such infected milk may be obtained from an apparently healthy cow. Amongst the lower classes of the community it is the exception rather than the rule for milk to be boiled before it is given to children, and hence it is probable that tubercle is frequently introduced into the body by way of the alimentary canal. The first effects of such introduction are manifest upon the mesenteric glands, which may perhaps act as a filter to check the further spread of the disease, but at the same time suffer an impairment of their own function and so give rise to imperfect intestinal digestion and to general wasting. It is a matter of common experience that children who have every appearance of being "tubercular" may be reared without the occurrence of any form of tubercular disease. In other cases it is equally well known that children who have no apparent tendency to tubercle by heredity or otherwise, may become victims of the disease. The neglect of simple disorders of digestion, by whatever means they arise, may be responsible for this.

Occasional pains in the stomach after food and slight irregularities of the bowel are but too often disregarded, and so long as the child appears to get well again without much physic, the matter is passed by without notice. Imperfect digestion allowed to proceed beyond a certain point is, however, bound to bring its Nemesis, and at last even to the careless the child becomes really ill, and the doctor is called in. What is often called low fever or bilious fever, or more shortly biliousness, occurs. Even then it is quite possible for the parent to be contented with having given the illness a name, or with having induced the doctor to do so. But these attacks, sometimes very acute, of so-called "biliousness," are often a serious warning that the child's capacity for good digestion is in jeopardy. It is not enough to prescribe the dose of castor oil or of rhubarb and magnesia of tradition, but a careful investigation is necessary as to the reason why such a dose is required. Generally speaking inquiry will show that the diet of the child has been unsuitable in some direction, either of quantity or of quality, or that the food has been given at improper times, or that the child has been allowed to eat sweets and other "messes" between meals, which have interfered with the normal processes in the stomach.

In the management, then, of the dyspepsia of the phthisical, whether in the young or in adult patients, we have to regulate the diet. We have in another section given directions as to the best way of feeding the phthisical patient, and to these we must direct the reader's attention. Not only the exact kinds of food, but also the precise time of its administration and its amount should be most closely insisted upon, and much time and annoyance may be saved by writing out instructions upon these points in black and white. No general dietary can

be relied upon, and in each case it will well repay the time and labour expended upon it if the medical practítioner will take pains to inquire closely into the details of each case, especially investigating the likes and dislikes of his patient, and frame his instructions for diet upon his conception of the case as a whole. Experience has abundantly proved the difficulty of inducing patients and their friends to carry out oral advice, but the possession of written instructions to which they can refer when the spoken words have been forgotten, serves as a safeguard on both sides. Perhaps more important to the patient than the dietary which he is to follow, will be the catalogue of things forbidden, and great care should be exercised to ascertain what articles of food have been found by experience to disagree; but such a list must be peculiar to each individual, and hence it is essential that each case should be investigated and advised without reference to any other. General statements as to what will agree or disagree in any particular case are neither satisfactory nor trustworthy.

At the beginning of treatment, especially in cases where the stomach shows signs of dilatation, and where there is much flatulence or acid eructation, it is often advisable to effect periodic clearance of the stomach and intestines if possible. In some cases the use of large draughts of hot water at night and on rising in the morning would appear to relieve the symptoms of fermentative accumulations in the stomach. Emetics are rarely tolerated, but if they can be borne they frequently bring great relief. In the same way, the clearance of the stomach by means of a syphon tube is most effective in its purpose, although the passage of the œsophageal tube is rarely borne with equanimity by the average patient. A course of mild salines, which must also be adapted to the requirements

of each individual patient, will often be of great service in effecting a clearance of the intestines.

This may be prescribed in the form of:—

"Carlsbad Salts," ℥ii.
Ex Aquâ tepidâ, Oss.
To be taken in sips every morning before breakfast.

Or the following mixture of salts may be substituted for the more expensive natural Carlsbad:—

℞ Sodii Chloridi, part i.
Sodii Bicarbonatis, parts ii.
Sodii Sulphatis, parts iv.
One to two drachms to be taken in hot water before breakfast.

Instead of these a wineglassful of one of the natural aperient waters, viz., Friedrichshall, Hunyadi Janos or Æsculap, in a tumbler of hot water.

According to excellent authority, such a warm draught before any food has entered the stomach in the morning, not only produces gentle purgation, but also acts as a kind of lotion to the mucous membrane of the organ, and diminishes any excess of mucus which may be present. Not unfrequently, it must be admitted, it is necessary to give in the place of salines a brisk dose of calomel (gr. ii. to v.) in the form of pill. This appears to stimulate the secretion of bile, which is only too apt to be sluggish.

Together with these purgative drugs it is often of service to order an alkaline mixture to be taken about ten minutes or a quarter of an hour before meals. This stimulates the secretion of gastric juice. One of the following mixtures may be given:—

℞ Sodii Bicarbonat., gr. xv.
Sp. Chloroform, ♏x.
Tinct. Gentian. Co., ℥ss.
Infus. Rhei., } aa. ℥ss.
Aq. Menth. Pip., }

or

℞ Rad. Rhei. Contus, gr. xxv.
Rad. Zingiberis, gr. xv.
Rad. Gentianæ, ʒiss.
Sodii Bicarb., ʒiii.
Aq., Oi.

"Macerate for 24 hours and strain. One to two tablespoonfuls for a dose."

When the biliary secretion continues sluggish in spite of the calomel, a mixture containing either nitric or hydrochloric acid may be prescribed, thus :—

℞ Acid. Nitro-hydrochloric dil., ♏xv.
Infus. Gentian. Co., ℥i.

or

℞ Tinct. Nuc. Vom., ♏x.
Acid Hydrochlor. dil., ♏x.
Tinct. Capsici, ♏v.
Infus. Cinchon., ℥i.

Pain in the epigastrium after meals should be treated by sub-division of meals and administration of small quantities of digestible food at short intervals. A mixture containing some salt of bismuth will often be valuable, thus—

℞ Bismuth Subnitr., gr. x.
Sod. Bicarb., gr. v.
Mucilagin, ʒi.
Aq. Cinnamomi, ℥i.

When the pain is of a stabbing or lancinating kind it is as well to make use of counter-irritation over its seat, and a mustard leaf applied for quarter to half-an-hour will prove of service, or possibly a small blister. It may even be necessary to employ other drugs for the purpose of relief of this symptom, such, for example, as hydrocyanic acid, thus —

℞ Acid. Hydrocyan. dil., ♏v.
Liq. Bismuth, ʒi.
Tinct. Chloroform Co., ♏xv.
Aq., ℥i.

The feeling of distension after food, due to accumulation of "wind" in the stomach and intestines, is most often a troublesome symptom even after the careful regulation of the diet. It is generally accompanied by constipation, and passes off when the bowels are well moved, but it is often rendered less tiresome by the empirical administration of some carminative, such as Tr. Lavandulæ Co. (♏xx.), or by the addition of Ol. Menthæ Piperit. in minim doses to the mixture. Effervescing draughts may also be given with advantage, *e.g.*, ℞ Sodii Bicarb., gr. xx.; Aq. Distill., ℥i.; dissolve and add Acid Tartarici, previously dissolved in half an ounce of water, gr. xvii., to be taken during effervescence; or with Infusion of Calumba or Quassia substituted for the distilled water.

Anorexia is an exceedingly troublesome symptom to treat. It is perhaps best met by varying the diet as often as possible and by giving food in very small amounts. As a rule, however, it is an indication that the bowels are not acting regularly, and disappears when the constipation is relieved.

The simple tonic bitters, however, may be given with considerable success, and a wineglassful of Infusion of Quassia before meals frequently will be found to improve the appetite. Tincture of Nux Vomica, or small doses of Liquor Strychninæ (minims iii. to v.) added to the rhubarb medicine (*v.* p. 258), adds in this respect to its usefulness. Loss of appetite, when combined with flatulence, is an indication that there is going on in the stomach those fermentative changes about which we have spoken; tonics under such circumstances are of little use, and the symptom is not relieved until the contents of the stomach have been evacuated. This sometimes occurs as a result of a severe fit of cough-

ing, but it may have to be brought about by artificial means.

Nausea, again, is an indication as a rule of torpidity of the stomach, and is found connected with the fermentation of its contents. Rigid dieting, relief of constipation, or actual vomiting will often remove it for a time. There is no better way of treating this symptom, in our opinion, than by a good dose of calomel, or by a course of saline purges about which we have already spoken, and by ordering some effervescing saline after each meal (*e.g.*, p. 259).

We now turn to the question of the special conditions of indigestion which occur in the late cases of phthisis, when there is every reason to assume that there is actual atrophy of the glands which secrete the digestive fluids; we must direct our efforts to make use of the diminished digestive ferments, and not to expect that the digestion can possibly be as good as if the ferments were present in normal amount.

Very small meals, very easily digestible substances, and, if necessary, partial digestion of the food before it is given to the patient, should be the plan adopted. Thus, frequent small quantities of milk, with or without a little brandy, or of soup or of broth of some kind, repeated frequently, allows the weakened digestive powers to act in an effective way. The administration, with or before the chief meal of the day, of a pill containing one or other of the digestive ferments, *e.g.*, pepsin or papain. The best form of pill of this kind of which we have had experience is one that contains both of these substances —

℞ Pil Pepsinæ et Papain (Kirby), gr. v., bis terve.

Of the predigestion of food we speak elsewhere (Chap. XI.). So far this has not been found very satisfactory.

No way has been discovered to entirely mask the taste which appears to be inseparable from such preparations.

The method of washing out the stomach with water or a solution of hyposulphite of sodium (ʒss to Oi.) may be tried in suitable cases, and the patient, if intelligent enough, may be taught to syphon out his own stomach. Such a plan is, however, inseparably connected with inconvenience, and in some cases perhaps with danger.

In the majority of cases of chronic indigestion in phthisis, and especially where there is proof of the fermentation of the contents of the stomach, the use of creasote is often attended with much benefit, and the patient will in some instances improve under this who has apparently been unaffected by any other treatment (see p. 122).

Vomiting.—Very few sufferers from tubercular disease of the lungs escape the trouble and annoyance of vomiting during some part at least of the course of their disease. It may be among the earliest symptoms of the incipient disease, but it may occur at any time and bears no definite relation to the amount or progress of the pulmonary lesion. In the great majority of cases it is quite independent of any visible gastric lesion and must be classed as one of the neurotic phenomena of the disease. It is a common observation in all forms of irritative cough, whether due to pharyngeal, laryngeal, bronchial, or pulmonary causes, that the patient is forced to cough "till he retches." But the vomiting of phthisis, although apparently set up by a fit of coughing, does not stop short with the act of retching. It is most often observed in the early stages to accompany the cough that is apt to come on in the small hours of the morning, but at that hour the stomach is usually empty, and hence but little is actually ejected. In the early cases, too, retching and

vomiting may sometimes accompany the cough that comes on at other hours, but this is less often observed than with the morning attack. In the later stages, however, a much closer causative relation appears to subsist between the acts of vomiting and of coughing. The mere presence of food in the stomach is apt to give rise to a fit of coughing, especially if the food has been taken in large quantity or too quickly. This fit of coughing ends in an act of vomiting, whereby the stomach is often completely emptied. No nausea accompanies this vomiting, and patients are often able to take food again within a short time of the evacuation of the contents of their stomach. The vomited matters are not abnormal, either in appearance or reaction, but only vary according to the length of time the food has been in the stomach. Another form of vomiting must, however, be recognized, and it differs materially from the purely neurotic or sympathetic vomiting. In this form other symptoms of gastric disorder are present—a sense of weight or pain in the epigastrium shortly after the ingestion of a meal, with flatulence and sometimes nausea. In such cases vomiting is often set up by a cough, but may also occur without any such cause. The emptying of the stomach sometimes brings with it a sense of relief, and there is neither desire nor ability on the part of the patient to take food again until the usual period of hunger returns.

The concomitant circumstances under which the vomiting takes place must be carefully considered in determining the appropriate treatment.

In cases where vomiting occurs without symptoms of gastric disturbance, and only with the early morning cough, very little can be done for its relief. The cough is in itself, as already stated, a natural effort to clear away accumulations of secretion from the affected areas

in the lungs. The use of general tonics, and especially of Strychnia, is sometimes followed by a diminution in the frequency and the violence of this form of retching, which, as a rule, bears a direct relation to the general vigour of the patient, gradually ceasing altogether as his general nervous "tone" improves.

The second form of vomiting, which so often accompanies a cough set up by the ingestion of food, is of much greater importance to the patient and must be carefully watched and treated. Much may be done by insistence upon very slow and complete mastication and by subdivision of meals, never allowing the stomach to be in the least degree distended. In some cases it may be necessary to limit the food entirely to slops, administered at short intervals. The fact must always be borne in mind that in this form of reflex vomiting patients can often take food again shortly after the stomach has been emptied, and it is advisable in all cases to attempt to administer a little milk or broth or more substantial food if it can be taken as soon as the patient has quieted down after the distress caused by the act of vomiting. Unless this precaution be observed, it is almost in vain to hope that nutrition will be maintained in cases where such vomiting is a prominent symptom.

Sometimes the administration of a small dose of Hydrocyanic Acid (♏v.), with Liquor Bismuthi (ʒi.) and a little water, or of Tinct. Iodi ♏i., shortly before meals, would seem to have the effect of checking the tendency to cough, as well as the resultant vomiting, but as a general rule more may be done by regulating the manner of taking food than by the use of sedative drugs.

In respect of the vomiting which is associated with definite symptoms of gastric disorder, we have already spoken, and although when associated with cough the

same precautionary measures may be necessary as in the more neurotic cases, it will be found that the best results are obtained by the judicious use of predigested foods and regulation of the bowels.

Intestinal. — Diarrhœa and Constipation. — The action of the bowels is very frequently disturbed in the course of phthisis, and the tendency to such disturbance increases with the gradual advance of the disease. Constipation, looseness, or irregularity may be present, but from several independent examinations of large numbers of cases, taken without special selection, the relative frequency of such conditions does not appear to be so large as has generally been stated. Taking only cases in the early stages of the pronounced disease, 73 out of a total of 100 were free from any bowel irregularity. Of 100 more advanced cases the number of those without intestinal symptoms reached 54, whilst in 100 cases of the latter stages of the disease 41 were free from this complication. Taking the whole number it would thus appear that of 300 cases 56 per cent. were exempt from intestinal irregularity. These figures contrast somewhat sharply with those put forward by Louis, but it must be taken into consideration that children were included amongst his cases, whereas almost all cases taken from the records of the Chest Hospital are those of adults.

Of 100 cases of phthisis at all stages, irregularity of bowel action was noted in 18 cases, diarrhœa in only nine cases, and constipation in 15 cases, all the remainder being stated as "regular." Irregularity and constipation were most frequently met with in the cases in the middle stage of the disease, diarrhœa being most common in the later periods. The percentage of cases of diarrhœa being thus so much below the figure arrived at by some previous observers, a close examination of 172 consecutive

cases, taken from the records of another year, was made, and all cases taken out in which a history of previous diarrhœa, or of diarrhœa while in hospital, could be ascertained. Of these 172 cases, however, only 12 such cases could be discovered, and hence it must be assumed that diarrhœa as a complication of phthisis must be much less frequent than was formerly the case.

Errors and neglect in clinical observation must to a great extent vitiate the absolute value of hospital statistics, but as such errors and omissions are the outcome of careless clinical work, it is probable that modern statistics are at least as reliable as those of former times, now that the standard of medical work and education has been raised to a higher level. It is noteworthy that the figures obtained by Dr. Pollock in 1865 to illustrate the relative frequency of diarrhœa in phthisis showed almost as marked a difference from those obtained by Louis as do those which we now present from those of Dr. Pollock. These differences can only be explained in one of two ways: either the occurrence of diarrhœa in phthisis is less frequent than it was, or the clinical observations are less accurate. In justice to the many careful house physicians and others from whose work our statistics are compiled, we must assume the former cause to explain the difference.

Post-mortem evidence being, for the most part, derived from cases in the latest stages of the disease, shows a much higher percentage of intestinal complication than does the evidence afforded by the clinical reports. About 40 per cent. (from an analysis of 200 post-mortem reports) was the proportion of intestinal ulceration, taking the affections of large and small intestine together, but of these 200 cases the small intestine was alone affected in 18 cases, and the large intestine only in 16 cases. Of

these ulcerations, however, it must not be assumed that all were typically tuberculous. From the fact that enlarged mesenteric glands were only discovered in 18 cases, and actually tubercular glands only in 11 cases, it is evident that a large proportion of the intestinal lesions must be classed as simple ulcers, although probably set up in the first instance by a tubercular process.

From the foregoing observations it will be manifest that diarrhœa is by no means a common complication of the earlier and middle stages of phthisis, although it is of frequent occurrence in the later stages. Where it occurs early in the disease it is generally to be regarded in much the same light as a diarrhœa in a non-phthisical person, and hence amenable to similar lines of treatment. Bearing this fact in mind, there need be but little hesitation in giving purgative medicines to relieve such forms of diarrhœa in tubercular patients as arise from definite irritants and are of an acute kind. Tradition attaches a certain amount of caution in the use of purges under such circumstances, but caution is not really more necessary in dealing with these cases in the early stages than with those of a non-specific nature. An acute diarrhœa in a phthisical patient may, if neglected, become chronic as a result of ulceration which has been set up by the retention of the original irritant, and this is more likely to be the case in tubercular persons than in those whose tissues are vigorous. Hence the necessity for removal of intestinal irritants by purgative measures is even more necessary to the consumptive than to the healthy bowel. Auto-infection with tubercle takes place very slowly, and frequently does not take place at all even in the case of patients who may have been swallowing their tuberculous sputa at intervals for years, and there is strong evidence in support of the belief that such

infection is more likely to take place through an ulcerated surface than through an unbroken surface. Thus it becomes a necessary prophylactic measure to protect the intestine which is exposed to infection from any breach of its internal surface.

Treatment.—The occurrence of acute diarrhœa in a patient suffering from phthisis in any stage must not be allowed to go untreated. A rough classification, for purposes of treatment, may be made between the cases that are attended with acute abdominal pain and those in which the sudden looseness of the bowels is the only symptom.

If pain in the abdomen be present, and especially if there be nausea or vomiting at the same time, it is best, except in the latest stages of the disease, to use purges. In the great majority of cases a dose of Castor Oil, one or two tablespoonfuls with ten drops of Tincture of Opium, may be safely administered, and will often cut short the diarrhœa by removing its cause at once. The patient should be kept strictly at rest until the bowels have acted, and for a few hours afterwards, and if there be much pain, nothing is so soothing as warmth to the whole abdomen, either by means of hot flannels or by a large india-rubber hot-water bottle. Care should be taken to limit the diet to the simplest and most digestible forms of food, until the normal action of the bowel is restored, but in every case the limitation must be to such articles as previous experience has shown to the patient that he can take with ease and impunity.

If, as sometimes happens, the diarrhœa ceases for a time and then recurs without any active symptoms, such as pain or nausea, it is most effectively treated by the administration of saline purges, preferably by purgative mineral waters taken directly after rising in the morning

and followed by Dover's powder in five-grain doses given in the afternoon and evening of the same day. This treatment should not be repeated day after day, but an interval of twenty-four hours should be allowed to elapse during which the doses of Dover's powder may be given without the saline purges.

Cases, however, may occur in which the diarrhœa is attended by a great deal of pain and tenesmus, and hence by much annoyance and uncertainty to the patient. It will generally be found that some source of continued irritation is at work, and this is not unfrequently found to exist in the medicine which the patient may be taking, perhaps as a tonic or expectorant. Especially is this the case with carbonate of ammonia, by which an irritating diarrhœa is often kept up. But as in the case of food, so also with regard to drugs, the combination which will suit one may act as a direct irritant to another, and a watch must therefore be kept where any such suspicion attaches to a medicine taken in frequent daily doses. The character of the motions may in some cases give the clue to the nature of the irritant which may be at work, but as a rule simple looseness, sometimes with a certain amount of tenesmus, is the complaint, and the motions can only be described as watery.

The removal of the irritant, if it can be discovered, must be the first line of treatment in such cases, and the administration of Dilute Nitric Acid, ten minims, with half a drachm of Compound Tincture of Camphor, should be persevered with for several days after the actual diarrhœa has ceased.

Alternative methods of treatment of this form of continued irritable diarrhœa may be found in the use of Bismuth, combined with small doses of Opium or Morphia, but this is by no means so generally effective as the

mineral acid, except in cases where the recurrent diarrhœa is accompanied by recurrent catarrh of the upper air passages, as is sometimes the case. Whether a similar process is at work within the intestine must remain a matter for conjecture, as there are no positive indicative symptoms of the condition. Localized patches of hyperæmia of the intestinal mucous membrane without breach of surface are occasionally discovered in the rare cases where death occurs in the early stages of phthisis. These patches are in many cases quite free from any evidence of tubercular deposit in or about them, and hence must be classed as simple local inflammatory conditions, which in all probability find their expression in short attacks of diarrhœa.

Very often the treatment of diarrhœa in phthisis resolves itself into the administration of astringents pure and simple, and the Mist. Cretæ Aromatic (B.P.) may be given with the addition of Tr. Opii, minims v. to x., and Tr. Catechu, minims xx. to xxx., three or four times a day. In particularly obstinate cases the following mixture is often efficacious:—℞ Tr. Opii, minims x.; Tr. Catechu, drachm i.; Decoct. Hæmatoxyli ad unciam. In another class of cases, looseness of the bowels may be a frequent condition in patients with phthisis without any attendant pain or nausea. The motions are always loose and the actions occur twice or thrice daily, at irregular intervals, and the patient seeks relief more from the annoyance of the frequent and uncertain action than from any actual discomfort which the looseness itself causes. In some cases the patients will express themselves as feeling better while the looseness continues and are obviously the worse for any cessation of the bowel action which may be artificially induced by the use of astringents. In such cases, therefore, it is not advisable to attempt to complete

alteration of the intestinal habit. The simple expedient of wearing a firm silk or flannel binder to support the abdomen, without unduly compressing it, will sometimes suffice to render the action of the bowels less frequent, and contributes largely to the wearer's personal comfort. The time-honoured custom amongst European residents in the East of wearing the so-called "Cholera belt," although it is no protection against cholera, is founded on sound experience and undoubtedly has an excellent prophylactic effect against the occurrence of diarrhœa, when the conditions of life of the wearer strongly dispose to the attack of that complaint. Whether its action is to be attributed to the warmth that it gives, or to the mechanical support which it affords, or to the mental sense of immunity which it confers, is uncertain, but of its efficacy in fulfilling its purpose there can be no doubt, and it has been found to afford a similar degree of comfort to sufferers from the form of chronic diarrhœa to which reference has just been made.

It is in the later stages of consumption that diarrhœa is apt to become a troublesome symptom. Frequently, but by no means always, it is associated with disease in the larynx, and it has been assumed that the infection of the intestine with tubercle is due to the swallowing of the infected sputa from the larynx, around which it is apt to be collected, owing to the mechanical interference with free expectoration. That such a causative relation may exist it is not possible to deny, but experience has abundantly proved that the disease in the intestine may be set up and may pass through all its stages without any concomitant affection of the larynx. As already shown, tubercular ulceration may affect the large and the small bowel simultaneously or separately. The tubercular character of such ulceration is not always equally marked through-

out, and a form of simple and wide-spread ulceration may be sometimes found to accompany the tubercular lesion, especially in the large intestine. It is a striking clinical feature of these forms of ulceration that although they may give rise to deep excavation of the intestinal wall, they are very rarely attended either with hæmorrhage or perforation. Although diarrhœa in the later stages of consumption is almost always found to be caused by actual ulceration of the large or small intestine, it frequently happens that ulceration is present without giving rise to diarrhœa or any other disturbance of function that might serve to indicate its presence. Hence ulceration, particularly of the large intestine, is often found on examination to have been extensive, although its presence has been quite unsuspected during life.

From this fact arises the caution to which we have already referred as to the use of purgative drugs in tubercular disease. In the earlier stages, as we have shown, this caution need not be too closely regarded, but in the later stages it must not be forgotten, and when constipation is present the use of gentle purgatives is advisable. Small doses of mercurial purges, and other drugs which have a stimulant effect upon the secretion of the liver, are to be preferred to those which have a direct action upon the intestine.

℞ Hydrarg. Subchlor., gr. i.	℞ Podophyll. Res., gr. ½.
Ext. Belladonn., gr. ½.	Ext. Nuc. Vom., gr. i.
Ext. Hyoscyam., gr. iii.	Pil. Rhei. Co., gr. iii.
ft. pil. i.	ft. pil. i.

When diarrhœa is present in the later stages it is often well in the first instance to administer calomel in two-grain doses followed by a saline purge on the next morning, but when the bowels have acted after this treatment it is advisable to use opiate astringents at once. Nothing has

given better results in our hands than the combination of Aromatic Sulphuric Acid (♏xx.), Tinct Opii. (♏v.), and Aq. Camph. oz. i., every four hours, due attention being paid to rest in bed, simple diet and warmth and support to the abdomen. In some cases a more prompt result may be obtained by the use of the ordinary astringent mixtures containing Catechu, Opium, and Hæmatoxylum, already mentioned, while in others no result may be obtained by any drugs given by the mouth, although the ordinary Enema Opii will check the diarrhœa for a while. The persistent diarrhœa which sometimes is met with when the intestine is distinctly ulcerated will sometimes give way to the exhibition of small doses of Argenti Nitratis or Cupri Sulph. given in the form of pill. Thus —

℞ Argenti Nitratis, gr. $\frac{1}{6}$.
Pulveris Ipecacuanhæ Co., gr. ii.
Mucilaginis, q.s.
Misce, fiat pilula. Bis terve.

or ℞ Argenti Oxidi, gr. $\frac{1}{2}$.
Pulveris Opii, gr. $\frac{1}{2}$.
Mucilaginis, q.s.
Misce, fiat pilula. Bis terve.

or ℞ Cupri Sulphatis, gr. $\frac{1}{4}$.
Extracti Opii. gr $\frac{1}{4}$.
Confectionis Rosæ, q.s.
Misce, fiat pilula. Bis terve.

Failing success by one method, another must be tried, but in some cases the diarrhœa becomes absolutely intractable. These are generally the cases in which lardaceous changes have taken place in the intestinal wall, and hitherto no form of treatment has been devised which will serve to check the diarrhœa which arises from that cause.

As a general rule it will be found that the physician is far more often called upon to treat consumptive patients for the relief of *constipation* than for either acute or chronic diarrhœa. Constipation is the rule rather than the exception, and most cases require the aid of purgative

drugs at intervals, although the proportion of serious constipation, as already shown, is not very great, being about 15 per cent. Cases classed as suffering from "irregularity" are, as a rule, constipated rather than relaxed. In their susceptibility to the action of purgative drugs, tubercular persons differ very considerably. Hence the necessity for caution when treating a patient on this account for the first time. As a broad rule, mercurials are well tolerated. Calomel, in combination either with Colocynth and Hyoscyamus or Aloes, will generally produce a satisfactory result. The ordinary blue pill (grs. ii.), with Nux Vomica (gr. i.) and Ext. Belladonnæ (gr. ½), may be given every second day with advantage. Confection of Senna (ʒi.) or the Compound Liquorice Powder (ʒi.) may be used on the alternate days. A pill containing Extract of Nux Vomica (gr. i.), with Pil. Rhei Co. (grs. iii.), may be taken with the mid-day meal as an alternative. Failing success with the drugs we have named, the Liquid Extract of Cascara Sagrada (♏xxx.), with Glycerine (ʒi.), may be tried as a regular daily aperient, but no positive instructions can be laid down for such cases, as the susceptibility to purgative drugs is of great variety, and only the results of actual experience in individual cases can be trusted.

Fistula in Ano.—The association of Fistula in Ano with tubercular disease of the lungs has always been recognized as a clinical fact, although exact proof is wanting to show that in such cases the fistula is always of tubercular origin. It has been assumed that it arises from tubercular deposit in the anal mucous membrane or sub-mucous tissue, and that the presence and subsequent degeneration of this deposit gives rise in its turn to an inflammatory process, in the course of which pus is formed.

A sinus is thus created, which generally opens into the bowel by a comparatively large opening in the anal mucous membrane, and may extend superficially beneath the skin around the anus, until at some point the skin becomes inflamed, disintegrated, and perforated. It has further been assumed that, owing to the want of fat and the probably enfeebled nutrition of the parts, this superficial burrowing is more apt to take place in tuberculous people than in others. As against this theory of its causation must be set the undeniable facts that tubercular disease of the rectum is not a common condition, and that such superficial fistulæ are met with in other conditions. Opinion is divided as to the relative success or failure of operation in consumptive cases, but, according to some authorities, the results in the majority of such cases are good, provided that the sphincter ani be not too completely cut through. The question of treatment of this complication of consumption does not, however, depend to any great extent upon the exact pathological process that may have given rise to it. Its cure has in the hands of some surgeons been shown to be rapid and complete by means of the simple operation of dividing the sinus, or even by palliative and not by operative measures. But in advising upon this matter we have to consider not merely the relief of local discomfort, but the larger question of the result which such relief may bring to the course of the major disease. From the earliest times to the present the fact has been recognized that any source of continued suppuration in the body may exercise a definite effect upon the course of chronic inflammatory conditions, even of remote parts. The use of setons from time immemorial is sufficient proof of this fact, and their use was doubtless founded on the roughly ascertained fact that so long as chronic suppuration of glands or open sores

was continued, the progress of internal disease was often stayed, and that their suppression was often followed by fresh outbursts of the internal complaint. These observations, centuries old, are as clearly before our eyes as before those of our forbears, and although we cannot explain them we must not neglect them. Hence, in dealing with fistula in ano in any given case of phthisis, but especially in such cases as are subject to continuous pus-formation in the lung, we must weigh in the balance the relative advantages and risks which may follow the healing of the fistula and advise the patient accordingly, having due regard to his personal comfort as well as to the progress of the disease.

If the fistula be passive, giving rise to no marked irritation, but only to a daily discharge of pus, we should advise nothing more than strict attention to cleanliness and due care to prevent the bowels becoming constipated. The use of Vaseline, Lanoline, Vinolia, or similar emollient inserted into the anus before defæcation, and careful cleansing with water, and thorough drying of the parts after the daily evacuation, should be insisted on. The use of a small quantity of the same material or of Lanocreolin upon and around the anus before going to bed should also be made a routine practice, and the secretions from the fistulous opening should never be allowed to become dry.

Even in those cases where a moderate amount of irritation is present, provided that it be not sufficient to hamper the patient's movement, destroy his rest, or disturb his peace of mind, relief may be given by the use of emollient ointments such as Vaseline, containing 6% of Hydrochlorate of Cocaine, or Opium, or Belladonna ointments.

The question of operative treatment should only be considered when the patient's general health is directly

or indirectly affected by the continuance of the fistula. It is not always easy to decide to what extent the fistula must be held responsible for loss of weight, appetite, etc., and generally the matter has to be decided according to the degree of local annoyance that is set up. A marked difference of opinion is to be noted between surgical and medical writers on the subject. The surgeon operates, and in a fair proportion of consumptive cases he obtains satisfactory results, though not in all. Of the satisfactory cases he sees no more. They are cured and have no longer need for the advice or assistance of a surgeon. No physician of large experience amongst consumptive patients can fail to have been struck by the comparative frequency of an operation for fistula in the previous history of patients with active tubercular disease. Often the patients themselves suggest the connection between the healing of the fistula and the activity of the lung disease, and careful inquiry too often elicits evidence that cannot be explained away, showing that greater evil has arisen when the lesser has been suppressed. Experience of this kind must be taken seriously into consideration when advising for or against operative interference, and no operation should be advised unless the physician has good grounds for believing that the presence of the fistula, whether as an unbearable source of irritation, or as weighing too heavily on the patient's mind, or as leading him to use sedatives too freely etc., has become a serious element in the progress of the case. Much may be done to alleviate the mere local annoyance of a fistula, and in face of the facts that we have referred to, and the no less important fact that patients may recover from prolonged attacks of tubercular disease and recover good health with a continuously discharging fistula, we should counsel palliative in preference to operative measures in

every case where such treatment is sufficient to relieve the patient from unbearable local annoyance.

Two points remain to be considered in estimating the advantage or otherwise of operative interference. A fistula in a tubercular person is not, as we have already shown, of necessity a tubercular lesion. It may have arisen without any such cause, but it is at all times liable to become tuberculous. Bacilli have been found not only in the purulent discharges from a fistulous opening, but also in the indurated tissue forming the walls of the fistula itself. Hence the fistula must be classed as a tubercular focus, when once it has been proved to contain tubercular tissue, and therefore as a constant source of possible infection of the whole system, just as superficial tubercular glands are so regarded. From this point of view its obliteration would be clearly indicated, and if no actual disease of lung or other organ were present, we should strongly advise that such a tubercular fistula should be immediately eradicated and all the indurated tissue about it thoroughly scraped away. But such forms of fistula are very rare, and concomitant tubercular disease is present in by far the larger number of cases in which the presence of tubercular tissue in the fistula can be proved.

Peritoneum.—Tubercular affections of the peritoneum, although most often met with in children without obvious disease of the lung, may, nevertheless, appear as complications of phthisis at any stage of the disease and at any age of the patient. Amongst adults it is certainly more common in males than females. It must be regarded as a secondary infection from some previous focus of tubercular disease. In males this focus may sometimes be discovered in the testes or vesiculæ seminales, and in females in the Fallopian tubes or ovaries. But cases are

frequently to be met with where no such focus of previous disease can be detected, and infection may then be traced to the spread of tubercular ulceration of the intestine from which the mesenteric glands have become in turn attacked.

The onset of this complication is almost always slow and insidious. Indefinite pains in the abdomen are accompanied by some irregularity in the action of the bowels and occasional passage of undigested food, associated with sensations of general illness and want of vigour, and sometimes with a moderate degree of wasting and rise of temperature. These symptoms vary in their extent in different individuals, and may often subside after a fortnight's care, but in other cases the symptoms persist in spite of treatment, and any improvement that takes place is only temporary.

In dealing with the earlier stages, it is generally advisable to keep the patient in bed so long as pains are complained of. With subsidence of pains, the patient may be allowed to get up, provided that other symptoms are favourable, but it is generally advisable to maintain equal pressure and warmth over the abdomen by means of a broad belt of flannel. Great care must be exercised in the regulation of the diet and the action of the bowels. The appetite is apt to be capricious and must not be considered as a guide either as to the variety or the amount of food which the patient should take. The diet should be carefully restricted to milk, broth or beef tea, meat jelly, or if there be marked symptoms of indigestion, to peptonized milk and broth only.

The action of the bowels should be closely watched and the restricted diet maintained until the motions have regained their normal appearance. An occasional dose of Calomel may be given with advantage, but as a rule

active purgation is not called for. Under such methods of treatment the simple cases can be guided back into healthy conditions without difficulty, but it generally happens that cases have advanced beyond the simple stages before the physician's advice is sought. If the earlier stages have been neglected the disease may have already affected a considerable area of the peritoneum and the symptoms are more distressing to the patient and the physical signs more marked. The pain is greater, tenderness to pressure is increased, the action of the bowels becomes more irregular and irritating, and the general body wasting proceeds more rapidly. The actual condition of the abdomen varies considerably in different cases. It may be hard and retracted or it may be full, tumid, and relaxed. Fluid may or may not be detected by palpation. A reddish blush is not infrequently seen on the skin, generally about the umbilicus, or between that point and the pubes. There may be local tenderness associated with it, and sometimes a certain amount of subcutaneous œdema, producing a somewhat brawny sensation to the touch. This blush may disappear after a short time even when the disease is progressive, or it may persist throughout, but its appearance is highly suggestive of tubercular disease of the peritoneum, as it is rarely met with under other conditions. If the presence of fluid be detected, it is very important to ascertain if possible whether such fluid lies freely in the peritoneal cavity or whether it be pent up in places by adhesions of the intestines to one another or to the omentum or to the abdominal wall. In some cases there may be a large effusion of serous fluid, which may be either clear or milky or even blood-stained. In other cases the inflammatory process is more plastic, and much lymph is formed, which lies in ridges in the angle of contact be-

tween one coil of intestine and another, welding them together and uniting them to the omentum and to the parietal peritoneum. Small areas thus become enclosed, into which lymph or serous fluid effusion may take place, and thus localized collections of fluid are formed, which may be tightly distended and may give to the hand applied over the abdomen the sensation of solid masses. In advanced cases the irregular projection of these pent-up effusions may be visible through the wall of the abdomen, and it has not unfrequently happened that a diagnosis of sarcoma has been made in cases where tubercular disease in the body elsewhere has not been obvious.

The diagnosis is sometimes aided by the periodical presence of pus in the urine. This occurs in the rare instances in men where the vesiculæ seminales are the primary seats of the tubercular process. Pus accumulates in these channels, and when their distension reaches a certain point is discharged and appears in the urine, which in the interval may remain perfectly free from pus or albumen.

The course of the temperature is febrile, the thermometer rarely indicating the normal either by day or by night. The diurnal fluctuations closely resemble those of acute tubercular disease in the lungs.

With the general infection of the peritoneum there is always, more or less, uniform swelling of the mesenteric glands, some of which may even become converted into masses of tubercular material, in which hardly any glandular structure remains visible. Intestinal digestion and absorption are thus materially interfered with, and a general loss of body weight ensues. With this diarrhœa is commonly present, irritation being set up by the imperfectly digested food which may pass through the

whole length of the intestinal canal in much the same state as it left the stomach. Actual tubercular ulceration of the intestine is not of necessity present in this condition, although it may be often found.

In these later stages of the disease treatment is less successful, but much relief may be obtained by careful management, and the disease will often remain quiescent for considerable periods.

When fluid is present it is, as already stated, of great importance to find out whether it be lying free in the peritoneal cavity or whether it be pent up by adhesions. In some cases the ordinary methods of palpation are sufficient, but in others it is extremely difficult to ascertain the condition with certainty. The use of a fine trochar or needle should not be omitted, but if the fluid ceases to run through the cannula while the abdomen still appears to contain fluid it is to be assumed that adhesions are present. If a considerable quantity of fluid has been removed, it is advisable to apply mercurial ointment freely to the surface of the abdomen continuously for several days and to support the abdomen with a flannel binder.

More important, however, than this local treatment is the regulation of the supply of food, according to the evidences of disordered gastric digestion or intestinal absorption that may be present in each case. In order to obtain information on these points it is essential that the progress of the general body weight and the character of the motions should be very closely noted. The medical adviser in such cases must know clearly the amount and quality of food that his patient has taken, and must be ever on the watch for evidences of imperfect digestion of any of the constituents of the dietary. In those cases in which even milk is found to pass through the alimentary

canal with little or no change it will be necessary to restrict the patient to the use of predigested foods and to effect a clearance of the canal, preferably by the use of calomel, every few days. Such a patient may take three pints of peptonized milk in the twenty-four hours, but the milk must be given in small quantities at short intervals. The diet is monotonous and may soon become distasteful to the patient, and hence a small quantity of plain boiled milk and soda-water with a teaspoonful of good brandy or whisky may be allowed twice or three times in the day, but if, as generally happens, the abdominal pain is soon relieved and the diarrhœa made less by the peptonized milk, it is wiser to urge the patient to continue its use as long as possible. The freedom from intestinal irritation thus obtained, if it can be continued long enough, is followed by a general improvement in the functional activity of the bowel, so that an amount of assimilation is possible when a more varied diet is resumed, which before was impossible.

Very little can be effected by the use of drugs, other than the mercurials already referred to. Diarrhœa may sometimes be so severe as to call for the use of strong astringents and opiates, but it is always best to endeavour to check it in the first instance by the administration of predigested foods. The following combination has often been found useful: —

℞ Acid. Sulph. Aromat., ♏xx.
Tinct. Capsici, ♏v.
Tinct. Opii, ♏v.
Aq. Camph., ℥i.

Of operative treatment, much has been written of late years in consequence of the success which has attended simple drainage and sometimes free cleansing of the peritoneal cavity. Such treatment should, however, be

reserved for the class of cases in which the fluid lies free in the cavity and has re-accumulated rapidly after simple tapping. Incision and simple drainage would seem to have given quite as good results as the more extensive operation of washing out. In the cases which are complicated by adhesions and local collections of fluid more harm than good is likely to ensue from an incision through the abdominal wall. Apart from the fact that free drainage is impossible, there is considerable danger of establishing a fæcal fistula, and even if this do not take place such incisions are extremely difficult to heal, and are only too likely to remain open till the end of the case, constituting a constant source of annoyance to the patient and of embarrassment to the surgeon.

Complications.—Headache and Meningitis.—Among the many minor troubles from which consumptive persons suffer at one time or another of their disease, headache always takes a prominent place. Such headache, however, is not always due to a single cause, nor is it always to be treated by a routine method. The chief of these causes, in frequency if not in importance, is unquestionably the disturbed circulation which follows a constant hacking cough. In those cases in which the cough is irritable and uncontrollable, and at the same time seems to give no relief and to bring no secretions with it or after it, the cerebral circulation is being constantly interfered with to a greater or less degree. The patient may not always cough himself "black in the face," but he very frequently gives evidence of the cerebral obstruction by redness of the face, watering of the eyes, or even a slight degree of cyanosis. Added to this obstruction is the violent shake of the whole body, including the head, which accompanies every explosive cough and so prevents rest. Digestive disturbances and constipation must be set

down as another potent cause of headache, generally of a dull and persistent character. In both these forms of headache there is rarely much interference with general health, apart from the pain or annoyance of the headache itself. The patient can still eat and drink and take a general interest in his surroundings. Another form of headache which is also frequently seen, especially in the more florid types of cases, is that which is accompanied with very considerable nervous depression, loss of appetite, and disinclination to take an interest in anything. Finally comes the headache which is due to actual inflammatory changes in the meninges, whether accompanied or not by tubercular deposit.

Treatment of Headache.—The causes of headache in phthisis being, as shown in the previous section, extremely various, it follows that successful treatment must be adapted to the special circumstances of each individual case. In the class first enumerated, viz., that in which the headache may be attributed to the mechanical effects of the cough, it is obvious that no treatment will be successful so long as the mechanical cause of the trouble remains unrelieved. The treatment of the headache must be the treatment of the cough. It must be remembered, however, that the convulsive and violent persistent cough so often met with in phthisis is not always the result of local irritation only, but that the condition vaguely described as nervous irritability has to be recognized and dealt with if the cough is to be suppressed. By the term "nervous irritability" is implied that condition of the nervous system in which reflex movements are excited by very slight stimuli and are prone to recur with every fresh recurrence of such stimuli, however slight they may be. In dealing with the persistent spasmodic cough, therefore, there are two factors to be borne in mind, both

of which are amenable to treatment in a greater or less degree. On the one hand, there is the inherent tendency to cough on the smallest provocation, and, on the other, there is the cause of provocation in itself, be it ever so slight.

Of the local sources of irritation which are liable to set up cough we speak elsewhere (p. 307), and it is only necessary here to point out that in all cases of headache due to the vibration or congestion set up by an irritative cough, it is more than ever necessary that careful attention should be given to ascertain the possible presence of any of them.

That gastric and intestinal irritation is a common condition in many stages of phthisis will be shown in another section and the indications for its treatment dealt with. As a secondary cause of headache it is always to be borne in mind, and it must not be forgotten that the headache may sometimes be the first symptom and may call for treatment before the local symptoms have attracted much attention. Frontal and vertical headache of a dull or throbbing character, accompanied or not by indefinite sensations of weight or discomfort after meals in the epigastric region, is often rapidly relieved by an act of vomiting, whether it occur spontaneously or whether it be induced. The use of emetics in this country is not popular. Most persons would prefer to endure hours of headache in preference to a few moments of vomiting, and hence the longer and less satisfactory process of intestinal evacuation must generally be resorted to. But here, as pointed out elsewhere, we have to recognize the abnormally irritable condition of the bowels in phthisis, and the possibility that a greater or less amount of ulceration may be present in the later stages which may be aggravated by any violent purging. If evacuation by vomiting be

out of the question, it is usually better to try and bring about the better solution of the food in the stomach, and this may be done to some extent by the administration of small doses of Pepsin or Papain, followed by small draughts of water, acidulated with Dilute Hydrochloric Acid (♏ x. to 4 oz. of water); by the administration of maltine (ʒi.) directly after the principal meals, and by the dietetic and other means laid down under the heading of gastric complications (p. 255). Saline purges taken once or twice a week in the early morning, and followed after the first free evacuation by a 10-grain dose of Dover's powder, or, still better, by the immediate introduction of a morphia suppository, will in many cases suffice to clear away a good deal of the residual and undigested material, and with it the dull headache. In some cases, where there is no evidence of undue intestinal irritation, a dose of calomel (grs. ii.) will often have an immediate effect, presumably by its stimulant action upon the hepatic secretion, even though it does not produce an excessive alvine evacuation.

In the class of headache where the patient's general well-being seems to be influenced by the headache itself, and where relief by the means suggested above is not obtainable, the use of one or other of the so-called nerve sedatives is called for. Of these there are a few which appear to exercise a very decidedly soothing influence in certain cases. It is, however, necessary to remember that in the success or failure of this class of drugs a great deal depends upon the individual susceptibilities of the patient, and hence if no success should be obtained by one, another should be tried. Want of sound sleep is a common feature to most of these cases, and it not infrequently happens that the mere inducement of refreshing sleep is in itself sufficient to banish the headache during the next

twenty-four hours. Hydrobromic acid (grs. x.), Bromide of Ammonium (grs. x-xx.), Hydrate of Chloral (grs. v-xx.), Sulphonal (grs. x-xx.), Antipyrin (grs. x.), Citrate of Caffein (grs. v-xv.), Phenacetin (grs. x.), have each proved successful in their turn, the beneficial action of the two latter being the most marked, and especially in cases of limited and local neuralgic pains in the head. The ammonium bromide appears to be more especially suited to cases of wakefulness and nocturnal excitement and palpitation, coupled with headache. For these the following combination has often been found effective :—

Ammon. Brom., grs. xx.
Tinct. Belladon., ♏xv.
Syrup. Limonis, ♏xxx.
Aq. Camph. "As a night draught."

A more serious form of headache, and one less easily dealt with, is that in which the patient becomes very drowsy, sometimes confused in his mind, or even delirious. The headache is often a minor trouble, and is rarely acutely painful. The special senses are often affected. The sight may be impaired or confused, and there may at first be some degree of photophobia. Slight deafness or noises in the head may be complained of. The patient objects to being disturbed, and sometimes exhibits a bad temper or moroseness which may be quite foreign to his nature in health. With the onset of such symptoms as these, the development of actual tubercular disease in the meninges must be suspected. Treatment must be immediately applied, but the prognosis in such cases must be very guarded, since post-mortem evidence goes to show that slight attacks of meningitis may occur and may subside as completely in course of time as do the passing attacks of pleuritis to which all phthisical patients are liable. At the same time the fact cannot be overlooked

that cases of meningitis often pass from bad to worse in a very short period, and that it is impossible to tell from the symptoms at the outset whether the case is to turn out a simple and temporary complication, or whether it is to bring a rapid and fatal termination to the case.

With the first appearance of such symptoms as those referred to, it is necessary that the patient should be kept very quiet and in a darkened room. Cold applications should be applied to the head, either by means of india-rubber bags containing iced water or by soft cloths with small pieces of ice strewn in the folds, or by means of Leiter's tubes. If local pains be severe, the direct application of leeches at the painful spot will often bring relief, or if there be much fulness of veins and throbbing in the head venæsection should be practised. As a general rule it is advisable to administer Calomel every second day in doses varying from 1 to 3 grains according to the special features of the case. Care must, however, be taken in those cases in which intestinal irritability has been shown, or where there is reason to suppose that actual ulceration of the bowel is present. In such cases it is best to leave the action of the bowels to nature, or, if actual clearance be required, to trust to simple intestinal purgatives, such as Castor Oil, and to the occasional use of castor oil enemata. During the earlier stages, when nervous irritability is often considerable, small enemata containing 20 grains of Hydrate of Chloral may be of service, and are preferable to opiates. Diet should be restricted as far as possible to milk and to nutrient jellies in quantity according to the patient's apparent powers of assimilation. One point above all must be kept in view, viz., that the head must be kept as cool and the feet as warm as possible. Hot bottles to the feet and cold applications to the head must be kept constantly applied.

Drugs are not of very much service in this condition. If the temperature ranges high some satisfaction may be afforded by the use of Antipyrin. Large doses of Iodide of Potassium and mercurial inunctions have often been used, but it cannot be said that any marked results have followed that line of treatment. Failure of the cardiac or renal functions may call for the administration of Digitalis or other diuretics; but that is not often the case, except when the patient has passed through the more active stage and is recovering from the attack. Great care is requisite at this stage to build up the patient's strength by slow degrees, avoiding, on the one hand, too rapid a return to ordinary diet and modes of life, and, on the other, too tardy advance from the restricted to the more liberal regimen. As a broad rule it is best to follow the desires and inclinations of the patient himself as regards quantity of food, taking care to keep on the safe side and never allowing him to indulge his appetite to the full; in other words, to allow him a little less than he wants.

At all periods of life the symptoms of meningitis may appear, but the response to treatment is more marked in the adult than the child.

Kidneys and Urinary Apparatus.—Renal affections are not prominent amongst the complications of phthisis. In by far the larger proportion of post-mortem examinations the kidneys are found to be healthy, but there are nevertheless certain degenerative or inflammatory conditions which occur too frequently to permit of their being passed over as unimportant. As to the exact proportion in which the kidneys are the subject of actual tubercular deposit or degeneration, authorities have differed from time to time. Peacock, Bamberger, and other careful clinical observers have placed the proportion at about 15 per cent., but our own observations of 200 consecutive

cases of tubercular disease of the lungs go to prove that the proportion is considerably smaller. Of these 200 cases we find only 18 instances of tubercular disease or deposit in the kidneys recorded post-mortem. This proportion is so far below that which has been established by other observers that some doubt might be attached to the correctness of the observation, but it must be remembered that cases of children are absolutely excluded from Victoria Park Hospital, and hence the figures may not be compared with those which are derived from the analysis of cases at all ages. The proportion of fatty, congestive, and fibroid changes is, on the other hand, much more nearly in accord with hitherto accepted statistics. Of these chronic conditions a state of passive congestion is very frequently discovered, but a certain amount of fibroid induration, whether accompanied by congestion or other morbid states, is by far the most common. Actual inflammation of the kidney is extremely rare amongst the cases referred to, and enlargement is but seldom noted, thus forming a striking contrast with Lebert's cases, in 20 per cent. of which acute or chronic nephritis was present. The instances of fatty change stand next in order of frequency to those of congestion, but the occurrence of lardaceous disease appears much less frequently than either. In the statistics of some previous observers the proportion of lardaceous disease is placed as high as 26 per cent.

Whatever may be the exact proportion in which they occur, one thing is manifest with regard to the renal complications of phthisis, viz., that they are for the most part insidious in their onset and very slow in their progress. Unlike the changes which occur in the kidneys under other conditions, they appear to make progress without exercising much influence upon the other great

internal organs. Especially is this the case with respect to the heart, which does not undergo that hypertrophy of its left side which is so commonly associated with the so-called simple affections of the kidney. Hence it must be assumed that there is no marked obstruction offered to the circulation, and as a clinical fact it is to be noted that albuminuria is but seldom induced, even where very considerable alterations of the kidney structure may have been gradually brought about. The presence of albuminuria has been said to exercise a lowering effect upon the temperature.

Although not prominently indicated by special symptoms, the chronic changes that are liable to take place in the kidneys in the course of phthisis must not be forgotten, and close watch should be kept upon the manner in which the renal functions are carried on. The quantity of urine secreted and its chemical composition should be observed at frequent intervals, and by this means traces of albumen —variations in the quantity secreted and occasional deposits—may be from time to time noted. It will sometimes be found on inquiry that patients have suffered from disease of the kidneys at some previous time, and hence the connection with the tubercular disease may be accidental, but in all such cases the renal symptoms are at any time liable to become prominent, although, as already stated, they are usually quiescent in association with tubercular disease in the lung.

Increase of tension in the pulse with headache should be met by the administration of small doses of Calomel subject to the precautions already mentioned, and occasionally vapour baths to induce sweating may be called for, but as a rule the treatment of the renal condition must be merged in that of the more important lesion in the lungs.

Cases of phthisis are met with from time to time, in which varying quantities of pus may appear in the urine. Careful examination with the microscope must be made in such cases to ascertain whether this pus comes from the kidney or the bladder. The presence of the different forms of epithelial cells and other deposits will usually suffice to decide the question. If the discharge contains a large number of renal cells it must be concluded that a suppurative tubercular process is probably taking place in the kidney; but in such cases it often happens that the ureters and bladder become secondarily infected, and hence the presence or absence of such indications must be inquired into. Many instances have been recorded of primary disease of the kidneys followed by changes in the bladder, vesiculæ seminales, and testicles, and ultimately by tubercular disease of the lung. In like manner tubercular disease of the kidneys in women may lead to infection of other parts of the genito-urinary tract, although the disease is more often primary in the Fallopian tubes.

An important symptom of suppuration within the vesiculæ seminales is an intermittent appearance of pus in the urine. The tubes become distended and their contents are poured out, but the discharge may then cease until the same point of distension has again been reached.

In many of these cases, however, the primary onset of the disease in the genito-urinary tract is more apparent than real. A latent focus of tubercle is usually found on examination within the chest, although giving rise to no symptoms or physical signs during life.

The practical treatment of tuberculosis of the pelvic organs belongs to the province of the surgeon or the obstetrician rather than to that of the physician. Operative measures are generally necessary and must not be delayed when that necessity has once been diagnosed.

Unlike tubercular affections of some other parts, the disease in the pelvis does not often tend to fibrosis or quiescence, and is at all times a standing danger owing to its liability to lead to absorption and general infection. The constant drain of pus in the suppurative conditions is liable, moreover, to reduce the patient's general strength and vigour, and so to favour the development of any latent tubercle that may be present in the lungs.

Liver.—Complications in connection with the liver in phthisis are of more importance from a pathological point of view than from the standpoint of treatment. The most common form of hepatic derangement is *fatty degeneration*, which is noticed not infrequently at autopsies upon cases of chronic phthisis. Coupled with this change is generally found a diminution of bile in the gall bladder. The degeneration is seldom marked by any sensible alteration in the size of the liver, and the abnormal change in the hepatic tissue is probably one which commences at a late period in the course of the tubercular affection of the lungs. Its presence during life is seldom indicated by symptoms other than those of diminished function—pain and jaundice being absent. In some cases of chronic phthisis the liver is found after death to have undergone some degree of *lardaceous degeneration*, with or without a similar change in the spleen and intestines, and more rarely in the kidney. This degeneration of the liver is seldom accompanied by that enlargement with which it is so often accompanied under other conditions. As in the case of the fatty degeneration so with this, there are no marked symptoms pointing specially to the liver—no pain, no jaundice, and no great degree of enlargement. Rarely is the liver the seat of *tubercular deposits.* When this occurs we have to do either with a late stage of tuberculosis of the lung or of an earlier

stage in which the deposit of tubercle has occurred in the intestine, the mesenteric glands, or the peritoneum. In some cases it has been noticed that such tubercular deposits in the liver break down into small *tubercular abscesses*, and these on post-mortem examination are almost always distinctly tinged with bile. That such tubercular abscesses may sometimes be single and larger in extent is more than probable. We have never noticed that during life cases which have shown upon autopsy tubercular deposits or tubercular abscesses have been accompanied with pain in the hepatic region, high fever, or jaundice; neither has it been recorded in our clinical notes that rigors have ushered in the spurious formation of pus. Occasionally it has been noticed that the liver is somewhat *congested* or even *cirrhosed* in phthisical autopsies, but these abnormalities even when present are slight, or are referable to some other intercurrent affection.

In considering, then, the question of hepatic complications with a view to treatment we are confronted by the fact that there are few signs to draw attention during life to any abnormal change which may be taking place. The principal fact in connection with all such changes, however, is the practical certainty that the secretion of bile is interfered with, and this may well be a factor in the causation of the dyspepsia about which we have already spoken. The principles of treatment of the dyspepsia of phthisis, too, have been already considered at some length and need not further be added to, but in connection with them should be recollected the possibility that the bile is being secreted in an abnormal manner. The partial abrogation of the function of the secreting cells of the liver, however, in other directions is of grave importance, and exercises a baleful influence upon the metabolism of

the other tissues. This unfortunately adds to the gravity of the case, as no treatment is available to restore their function. In early cases it is found that the use of Calomel or of some preparation of mercury is more efficacious than any other purgative in relieving the constipation and dyspepsia. The action of such drugs should, therefore, be tried in any cases where implication of the liver is suspected. In the same way, too, the use of the mineral acids, such as Acid. Nitrici Dil. ♏x. to xx., or Acid. Nitrohydchl. Dil. ♏x. to xx. t.d. may be tried. It has been stated that when the liver is implicated in the course of phthisis fatty foods are not digested; this at any rate is *probable* when the pancreas is also diseased. Under such circumstances it becomes a question whether it is not better to discontinue the use of cod-liver oil and other fatty foods, since to administer either bile or pancreatic ferments to assist the digestion of such substances has been found to be of little value.

As regards the idea that fatty degeneration of the liver in phthisis is brought about by the administration of cod-liver oil, it appears to us that such a view is based upon an imperfect conception of the physiological formation of fat.

CHAPTER IX.

THE TREATMENT OF THE SYMPTOMS OF PHTHISIS.

In former chapters we have given some account of the symptoms usually present in cases of phthisis, and have described briefly the chief plans which may be adopted for their relief. Some of these symptoms, however, are apt to arise under such different conditions, and often attain so great an importance from the point of view of treatment that they need some further consideration. Of the most important symptoms, we propose to deal in the present chapter with *Cough; Hæmoptysis; Pyrexia;* and *Night Sweating*, leaving the question of the best means of obviating *Wasting* until the whole subject of diet and feeding is under review. We have already devoted some attention in the last chapter to the subject of *Dyspepsia*, and to other symptoms connected with the complications of the disease.

Cough.—The cough which we are called upon to treat in pulmonary consumption is almost always, as one would expect, referable to the respiratory tract, to the lung tissue itself, or to the pleuræ. Some irritation applied to the endings of the branches of the vagus nerve[1] distributed

[1] "The afferent impulses of this reflex act (coughing) are in most cases . . . conveyed by the superior laryngeal nerve; but the movement may arise from stimuli applied to other afferent branches of the vagus nerve, such as those supplying the bronchial passages and stomach and the auricular branch distributed to the *meatus externus.* Stimulation of other nerves also, such as those of the skin by a draught of cold air, may develop a cough."—"Text Book of Physiology" (M. Foster), 5th Ed., p. 631.

in these situations reflexly causes violent efforts of the muscles of expiration, by means of which gusts of air are forced through the closed glottis with violence. The object of the strong expiratory efforts is to remove the cause of the irritation when this is possible. As a general rule that which produces cough in cases of phthisis is the presence of mucous or purulent secretion in some part of the air passages, although the implication of the sensory nerve terminations in the tubercular processes may also act in the same direction. The violence of the cough, however, is by no means in proportion to the amount of irritation which produces it; on the contrary, an effective cough sufficient to expel large quantities of accumulated secretion may be very slight; and the reverse. It would seem that the degree of violence of the cough chiefly depends upon—first, the position of the irritation, and, secondly, the condition of the mucous membrane or other tissue, where the irritation is applied. First, as regards the position of the irritation, the mucous membrane of the larynx, to which the superior laryngeal branch of the vagus is distributed on either side, is much more sensitive than that of the trachea and bronchi, and the sensibility diminishes downwards. It is due to this physiological fact that affections of the larynx are so often attended with irritative cough. In abnormal conditions of the respiratory mucous membrane, or indeed of the lung-tissue set up by congestion or inflammation, the sensibility of all these parts becomes abnormally increased, so that the slightest stimulus may act as an irritant and produce violent coughing, a draught of cold air, for example, being sufficient under the condition of hyperæsthesia of the sensory nerve endings to do so. There is one other factor, however, which must not be overlooked in the consideration of the nervous chain con-

cerned in the reflex act, viz., the condition of the central nervous system. It is thought that the respiratory centres themselves vary in degree of irritability, so that under some circumstances a comparatively feeble afferent impulse may produce violent and prolonged paroxysms of coughing. It is true that comparatively little is known about the circumstances inducing hyperæsthesia of these centres; but a not unreasonable supposition would attribute this sometimes, at any rate, to poisoning by the bacterial products. To summarize the matter, then, we have in the treatment of the coughs arising from irritation of the respiratory passages, or of the lung-tissue in phthisis, the following indications for treatment:—(*a*) To allay irritation of the peripheral nerve-endings in these situations, which may be done at one time by inhalations of steam or of medicated vapours, at another time by counter-irritation to the neighbourhood of the diseased process, or by anodynes; (*b*) to assist expectoration, sometimes by increasing the secretion of the mucous membrane involved, sometimes by diminishing the secretion, and sometimes by increasing the activity of the respiratory centres; (*c*) or in other ways to diminish the irritability of the respiratory centres when this is abnormal.

In the actual treatment of cough in pulmonary phthisis, we find the most difficulty with cases in which the expectoration is scanty, especially when the irritation is referable to the turbercular foci themselves. The general proposition, however, is not true, viz., that all cases in which the expectoration is scanty are accompanied by severe cough. To allay this form of cough with scanty expectoration there is a natural tendency on the part of the attendants to give a teaspoonful of a morphia linctus or one containing some preparation of opium very frequently. As a rule it is generally found that this treatment has no permanent good results, so that unless the patient is to

become habituated to the use of frequent doses of morphia, some other treatment must be employed. It sometimes appears the best treatment to endeavour to increase the secretion, and for this purpose Iodide of Potassium, given in doses of five grains and upwards three or four times a day, is often very successful. For the same purpose, Ipecacuanha, in the form of ten to fifteen minims of the vinum, is often useful, and in quite early cases good may follow the administration of tartar emetic, in the form of ten to twenty minims of the *vinum antimoniale*, given three or four times in the twenty-four hours. When there is extreme irritability, not only of the sensory nerve endings, but also of the central nervous system, indicated by exhausting and prolonged paroxysms of cough, the following prescription will be found useful:—

℞ Ammonii Bromid., grs. v. to x.
Potassii Bromid., grs. v. to x.
Tinct. Belladonn., ♏xv. to xx.
Syrup. Chloral, ♏xxx.
Aquam Camphor ad unciam. Ter die.

The employment of counter-irritants, such as Linimentum Iodi or Emplastrum Cantharidis, has already been commented on and recommended as a valuable means of checking cough. It may be tried in any stage of the disease when there is evidence of active mischief.

Another means of treatment often found to succeed is the persevering use of steam inhalations, either alone or medicated with Tincture of Benzoin, Turpentine, Creasote, Terebene, or Carbolic Acid. Whether administered in the simplest way by the use of the steam from a jug of hot water or from a special inhaler, or by means of the more complicated method by the inhalation of steam spray from a Siegle's spray producer, we generally find some considerable relief afforded. The use of a "bron-

chitis kettle" in the room in which a phthisical patient sleeps may also sometimes be employed with advantage.

Turning next to the cases in which the secretion is excessive, it will usually be found that the stimulating expectorants are successful, since, at any rate at first, the indication to be met is to assist expectoration rather than to diminish secretion.

The following prescriptions have over and over again been employed with satisfactory results:—

℞ Ammoniæ Carb., grs. v.
Vini Ipecac., ♏x.
Tinct. Scillæ, ♏xx.
Aquam Camph., ℥i. Ter die.

Or the same with the addition of Tinct. Belladonnæ, ♏xv.

℞ Tinct. Benzoini Co., ♏xv.
Tinct. Tolutan, mxv.
Mist. Ammoniaci, ℥ss.
Glycerini, ʒi.
Aquam ad ℥i. Ter die.

Or a more sedative mixture is the following:—

℞ Tinct. Benzoini Co., ʒss.
Tinct. Camph. Co., ʒss.
Syrupi Scillæ, ʒss.
Infus. Senegæ, ℥i.

In some cases the use of drugs, which are said to increase the activity of the respiratory centre, will be found of greater value than the stimulant expectorants. Such drugs as Strychnine, Nux Vomica, or Ammonia may be employed for this purpose. Generally speaking they are ordered in combination with the stimulating expectorants above mentioned. The following prescription is a type of those often made use of:—

℞ Ammon Carb., gr. v.
Tinct. Nucis Vom., ♏v. to x.
Spirit Chloroformi, ♏x.
Infusi Carophyll., unciam. Ter die

or

℞ Liquor. Strychninæ, ♏v.
Tinct. Ferri Perchlorid., ♏xx.
Glycerini, ʒi.
Infusi Calumbæ, unciam. Ter die.

The continued use of two drachm doses of Cod-liver Oil given twice a day should also not be forgotten as likely to relieve this kind of cough; it appears to act as an efficient expectorant.

The cough most difficult to treat when the expectoration is free is that which comes on at night with a peculiar periodicity, and tends to prevent sleep. This is very commonly treated with opiates, but the desired relief can in many cases be obtained by means which do not carry with them the unpleasant after consequences, viz., foul tongue and loss of appetite. Diffusible stimulants such as Ether and Ammonia, with or without the addition of Digitalis, will often be found effective in cutting short the paroxysms and in allowing the patient sleep for the remainder of the night. Thus:—

℞ Spirit. Ammoniæ Aromat., ♏xxx.
Spirit. Ætheris, ♏xx.
Aquæ Camphor, unciam.

or given with the addition of

Tinct. Digitalis, ♏vii. to xv., p.r.n.

Simple nutritive stimulants, such as strong beef-tea or milk with a couple of teaspoonsful of brandy to the tumbler, are frequently of service in place of actual drugs.

There are cases, however, in which, by the means already indicated, we are unable to keep the excessive secretion under control. Under such circumstances we are obliged to have recourse to Opium, Morphia, and their preparations. These drugs may be administered in the form of linctus already indicated (p. 120) or may be given

combined either with iron or with iodide of potassium, thus:—

℞ Liq. Morphinæ Hydrochlorat., ♏x.
Tinct. Ferri Perchlor., ♏xx.
Acid. Hydrochlor. dil., ♏v.
Syrup. Simplic., drachmam unam.
Aquam Destillat., ad unciam. Ter die.

or

℞ Liq. Morphinæ Acetatis, ♏iii.
Acid. Hydrocyan. dil., ♏ii.
Chloroformi, ♏i.
Potassii Iodid., grs. v.
Syrup. Simplic., drachmam unam.
Aquam Destillat., ad unciam. Ter die.

Instead of the preparations of opium and morphia, obstinate cases of excessive secretion sometimes yield to Atropine, given in the form of a pill, in doses from one hundredth to one seventy-fifth of a grain.

We have seen several cases of excessive secretion during phthisis when in a very severe form considerably improved by treatment in the "creasote chamber," described in the next chapter. Not only is the cough relieved, but after a time the secretion diminishes. This plan also obviates the fœtor occasionally present in such cases.

Sometimes when the degree of severity of the cough is out of proportion to the amount of sputum to be ejected it would seem to be due to the fact that the matter sought to be ejected is situated deeply within the lung tissue, as may be shown by the presence within it of particles of disintegrated lung tissue or degenerated tubercle. In those cases where the cavity or dilated tube or other source of sputum is near to a main bronchus the effort of coughing is sufficient to remove the irritant, and the cough ceases as soon as ejection has taken place.

Two other factors may occasionally be present which combine to obstruct the free removal of sputum. A high

degree of emphysema or other structural change in the lung tissue is the most common of these, and the other, far more distressing and less often met with, is an excessive amount of structural change in the larynx, whereby the closure of the glottis is mechanically prevented. The cough in the latter condition is ineffectual because it cannot be made explosive, and the best that the patient can do is to force a current of air through his open glottis with all the power that he can raise, but this is rarely strong enough to carry off the adherent mucopurulent discharges which hang about the larynx continually. Nothing but mechanical removal of such discharges by means of a brush or mop will suffice to clean the interior of the larynx, but this proceeding, if the patient bears it with equanimity, will often give relief from the distressing cough for several hours.

We have next to consider those forms of cough which appear to be due to some, more or less, remote source of irritation, and which are not attended with the ejection of sputum. Such a cough, when occurring in the person of a patient who is not the subject of phthisis, is generally regarded as due to other than pulmonary causes, and is often spoken of as a "stomach cough" or a "throat cough," etc. But such causes are equally active in the presence of pulmonary disease, and may be altogether unconnected with it. Hence it is necessary to examine carefully all parts of the upper air passages and also the auditory apparatus, and, in fact, all parts to which branches of the vagus are supplied, to ascertain the presence or absence of some morbid condition which may be contributing to if not actually causing the irritative cough. Sometimes the patient's own sensations will direct attention to the seat of the mischief, but more commonly such sensations are more misleading than

indicative. One of the commonest of these sensations is that of continued tickling in the throat. In many of such cases some morbid change is to be found either in the pharynx or the larynx if it be carefully sought for. Thus chronic pharyngitis, elongated uvula, or enlarged tonsils may have set up the irritation, or the very common condition of "granular pharynx." In cases where such a cause has been demonstrated the cough may often be stopped by demulcents, astringent gargles, or the like. It is seldom essential to shorten an elongated uvula, but the application of Perchloride of Iron or Nitrate of Silver to the pharynx or tonsils is more frequently indicated. If it can be clearly ascertained that a definite relation exists between the presence of the little "granular" masses and the irritative cough, no time should be lost in destroying the "granules" with the galvano-cautery. The operation is a very simple one, and can be rendered painless by the application of cocaine to the pharynx, but the relief from the tickling sensation is to be regarded as temporary, as the "granules" in the vast majority of cases will recur after a longer or shorter period.

No such treatment, however, should be attempted in any case where the tubercular disease has advanced or in which the general nutrition has been much impaired. Apart from causes in the pharynx, a tickling cough may sometimes be found associated with moderate degrees of simple laryngitis. The vocal cords may be only slightly reddened, or, as is more often the case, they present one or two inflamed patches on their surface. The application of a moderate astringent, such as Chloride or Sulphate of Zinc (grs. xv. to the oz.) will often suffice to check the tickling sensation when due to this cause. The more serious lesions in the larynx seem to be less often causative of tickling cough. Their effect is usually mechanical

rather than reflex, but if they appear to be giving rise to irritation treatment by sedatives such as morphia or cocaine locally is to be preferred to local astringent applications or cauterization. In some cases of tickling laryngeal cough where no obvious cause can be found, the use of medicated vapour at the ordinary temperature of the air by means of the "muzzle" inhaler will often bring relief to the local irritation (see Instillations, p. 340).

Steam inhalations medicated with half a drachm of Succus Conii will sometimes relieve cough when the source of irritation is referred to the trachea, but its use requires caution, as some persons are easily affected by conium, and are apt to complain of the lassitude and throat dryness which it may produce.

Sources of possible reflex irritation, apart from the pharynx and larynx, must be looked for in the ears and in the nose, but no operative interference with morbid conditions in these parts should be attempted until their positive connection with the cough is established beyond doubt. We have only too frequently met with patients who have submitted themselves to painful operations for the removal of such common conditions as irregularities in the nasal septum, enlargement of posterior lingual veins, etc., without the smallest relief being afforded to the irritable cough. Mindful of the fact that irritation of any afferent branch of the vagus may excite reflex cough, we must always take steps to remedy gastric disturbances, of which we have treated in dealing with "complications."

Chronic sources of irritation, becoming active from time to time, are frequently present within the chest, although their presence is not always easy to diagnose. Quiescent aneurysm, enlargement and induration of lymphatic glands, and pleuritic adhesions are the most common

causes of such coughs. A severe coughing fit is very apt to give rise to small lacerations of pleuritic adhesions, especially if they are of comparatively recent formation, and thus a point of reflex irritation is set up which serves to aggravate the cough that gave rise to it.

Such an occurrence is very often accompanied by local pain, and may best be treated by the application of local sedatives, such as a belladonna plaster or by fixing the painful side by means of strapping, so as to limit the respiratory excursions.

Very frequently it may happen that when all possible sources of reflex cough have been investigated, and some of them treated, still the cough persists. Especially is this the case in the class of cases where the main disease progresses insidiously without making the patient very ill. In such cases there are always a number of physical changes going on in the structure of the lung or pleura, fibrotic changes, slow destruction of vesicular walls, infiltration of lymph spaces, etc., all of which are liable to give rise to cough from time to time. Treatment by special drugs can do but little to ease coughs of this kind, and nothing more can be done than to maintain the general body vigour as far as possible. Change of air and surroundings may often have a marked effect upon the cough so caused, which may have resisted all other forms of treatment.

Hæmoptysis.—Hæmorrhage from the lung takes place in about 50 per cent. of all the cases of pulmonary tuberculosis, but the amount of the bleeding, the character of the onset, and the duration of the attack, as well as the period at which it takes place in the course of the affection, vary greatly. As regards the character of the bleeding, it has been found from statistics that it is severe in about half the cases, whilst in the other half it

is moderate or slight. It may commence suddenly with the bringing up of half-a-pint to a pint of blood in a few minutes, or it may begin with the expectoration of small amounts mixed with the phlegm. Sometimes the first attack is also the last, the patient succumbing to rupture of an aneurism in the lung, the sudden rush of blood producing suffocation in a few minutes; in other cases the whole course of the disease is accompanied by intercurrent attacks of blood-spitting.

Hæmoptysis of anything but the very mildest form is always a serious symptom, since small beginnings may lead to prolonged and severe hæmorrhage. No case, indeed, should be considered unimportant, and careful investigation into the possible source and cause should always be undertaken.

When the hæmorrhage is of the severe or "gushing" kind, the blood proceeds from the rupture of a small aneurysm or of a larger or smaller branch of the pulmonary artery, the walls of which have been rendered brittle from disease, *e.g.*, fatty degeneration, atheroma, or the like, or it may arise from encroachment of tubercle bacilli into the walls of the vessels themselves. This form, however, is not necessarily fatal, unless the rupture is complete, as clotting of the blood at the seat of the rupture may quickly occur. If the patient survive the first onslaught of the attack, the case passes into the second category of cases. The second form of severe hæmorrhage is that in which the bleeding goes on for days or even weeks with slight cessation, the patient spitting up two or more ounces in the twenty-four hours as a maximum, but seldom spitting less than a fourth of that quantity more or less mixed with phlegm. The bleeding is often very difficult to stop. There are, too, occasional sudden increases in the amount, and expectora-

tion of blood clot casts of the "bronchial tree" sometimes takes place.

The third, and perhaps the commonest form of blood-spitting, is of comparatively slight degree. The patient begins by spitting a teaspoonful or so of blood, and continues to do so for a day or two, and then expectorates more or less blood-stained sputum for several days more; the whole attack lasting perhaps a week. Sometimes the hæmorrhage is even less than this, and the sputum is never pure blood, but is merely tinged or streaked with it.

It should be recollected that our classification of hæmorrhages from the lungs is purely arbitrary, and for the sake of convenience. The first class passes into the second, as the second into the third, without a line of definite demarcation existing between them. So, too, the amount of blood in the sputum and the duration of the attack in the cases which we have included in the third class may be supposed to vary considerably.

It is a very striking fact that the severe attacks of hæmorrhage often occur when the phthisical patient is doing well and putting on weight, the very worst form of gushing hæmorrhage beginning with extreme suddenness. If the patient survive the attack for some days the mental depression is very severe and the temperature is almost certainly raised several degrees—not unfrequently to the height of 103 to 104 degrees F.—and continues high until the attack is over. It might be thought that the raised temperature precedes the hæmorrhage, but this is not the case; no rise is found upon the temperature chart of the day preceding the attack. Very often too, hæmoptysis begins in the early hours of the morning, when the activity of the circulation as well as the bodily temperature is at its lowest. After the first flow of blood

is over the sputum continues to contain blood for some days, but this soon becomes darker in colour and more clotted than that which was first discharged; before entirely disappearing generally assuming a deep brown colour. The time which elapses before the sputum in such cases resumes its normal appearance varies much. It depends upon the amount of blood which passed down into the pulmonary alveoli at the first onset; when this has been large in amount it necessarily follows that the period is prolonged. When there is continued mental depression and dyspnœa accompanying hæmorrhage from the lung, altogether out of proportion to the amount of blood expectorated, it will be generally found that there is an accumulation of clotted blood in the air passages, which may even extend to the main bronchus. Under such circumstances the expectoration of pellets of clotted blood, or even of portions of casts of the bronchi, will confirm the diagnosis. Sometimes these casts consist of almost pure fibrin, with little blood pigment remaining. A careful daily examination of the sputum therefore is always to be advised. It is essential also to carefully note the colour and other appearances of the blood which is daily expectorated in order to make sure that the bleeding is not continuing or beginning afresh. In the case of fresh blood being noticed from either of these causes a return to active hæmostatic measures is called for.

Turning now to the conditions under which the more moderate kind of active hæmorrhage takes place, we find, as a rule, evidence of activity of the tubercular processes in the lung. The range of temperature preceding the attack may be from 101 to 103 degrees F., and during the attack there is little or no appreciable increase of fever and but little anxiety. At the same time large quantities of blood may be lost in an attack of this kind,

as the bleeding may go on for several days. The sputum continues to be largely mixed with blood, bright and recently shed, and not that which has undergone decomposition, as in the cases above described. It is not an uncommon result of bleeding, or perhaps one ought to say not an uncommon sequence, that the patient's fever is reduced to a marked degree; but for all that, cases in which there are frequent attacks of hæmoptysis of this kind almost always do badly. It is probable that hæmorrhage of this degree arises from the extension of the tubercular mischief in the lung, and possibly from implication therein of small arteries.

The third form of hæmoptysis, namely, that in which the sputum is more or less mixed with blood, streaked or merely tinged, for some days at a time, is usually met with in cases of chronic and inactive lesions, and is generally a capillary or venous oozing. It is seldom or never accompanied with rise of temperature, and the depression of spirits is never marked except in nervous subjects. It is true that chronic cases suffer every now and then from more copious hæmorrhage, but then the attack probably indicates that an extension of the disease is taking place. Under these circumstances there will be found other symptoms, particularly rise of temperature, to confirm the diagnosis.

As regards the treatment of these three classes of cases, it is an unfortunate fact that the most severe form, due to a rupture of an aneurism or vessel of anything but the smallest size, is too often fatal before any treatment can be employed. Even when not immediately fatal it is always serious, and must be treated with the greatest care. After the first gush of blood has been expectorated, the patient must be induced to lie down, with the head supported upon as low a pillow as possible, and should be kept very

quiet. A large dose of Calomel (grs. v.) should be given at once and a Subcutaneous Injection of Morphia (gr. $\frac{1}{4}$) administered. Ice may be sucked, possibly more for its moral than for its actual effect, but no pounded ice or other cold application should be applied to the chest. The only effect of such application is to cause contraction of the superficial vessels, and hence a reduction in the amount of blood which they contain, and necessarily a hyperæmia of the deeper vessels. This is the very thing which should, under the circumstances, be avoided. There is no evidence to prove that the external application of cold to the skin over the chest has any reflex action whatever in causing constriction of the pulmonary blood-vessels, as was formerly supposed, or in diminishing the general or local blood pressure. The indications for treatment are sufficiently obvious, viz., to diminish the blood pressure and to expedite clotting at the point of leakage. The influence of brisk purgatives, such as calomel, in rapidly reducing the blood pressure is well-known, and we have to rely chiefly upon purges to attain this object, as venesection, which is theoretically sound can seldom be practised. To produce coagulation of the blood various drugs have been tried. Latterly salts of calcium, particularly Calcium Chloride in doses of from grs. x. to xx., repeated four to six times in the twenty-four hours, have been recommended, but we have, however, not yet had sufficient proof of its good effects to give any decided opinion as to its utility. According to our observation in an obstinate case of hæmoptysis, the calcium salt distinctly had the effect of increasing the coagulated appearance of the blood which was coughed up, but to produce this condition is obviously, from the reasons already indicated, not an unmixed good. In some cases Ergot, administered in large doses from one drachm and upwards, of the liquid extract, repeated several times within a short period,

or in subcutaneous or intra-muscular injection, has been largely used, and sometimes, no doubt, with good effect, but it is of little service in the very severe cases of gushing hæmorrhage. The same remarks apply to Turpentine, the use of which in some cases of bleeding from the lungs is highly to be recommended, but in sudden and severe hæmoptysis it is of doubtful value. As soon as the first severity of the bleeding has been stopped, the patient must be kept at complete rest and not allowed to rise from his bed for any purpose whatever until the pulse, which is almost always rapid and thready during the acute phase of the hæmorrhage, is quieted down, the bowels have acted regularly for some days, the rise of temperature has given way, and the patient's mental condition has been relieved. The diet should consist entirely of slop food, beef-tea, milk, and ice, and possibly chicken and other broth. As regards stimulants, except in the case of very severe mental agitation or a condition of prolonged faintness which sometimes occurs, and when stimulants are absolutely necessary, it is as well to do without alcohol. Care must be taken not to allow the diet to remain "low" too long; as soon as the chief hæmorrhage has stopped, fish and puddings may be added to the slop food, and later on meat may be substituted for fish. For the first two or three nights after an active and severe hæmorrhage an injection of morphia (gr. $\frac{1}{4}$) is indicated to produce sleep, to allay cough, and to quiet the circulation. Saline purges, such as Magnesiæ Sulphat., ʒi. to ʒii., must be continued for some time, combined with the mineral acids, *e.g.*, Acid. Sulphuric dil, ♏x.

In dealing with the second class of hæmoptysis, where the bleeding, more or less severe, takes place in the course of active disease, there is less immediate danger to life from actual loss of blood. Hence, if the symptoms are not much altered by the occurrence, less importance may

be laid upon absolute rest, but in other respects the same lines of treatment should be maintained. Saline purges of themselves seem often to be sufficient to stop the hæmorrhage, but sulphate of magnesia may be combined with Gallic Acid (gr. x.) and Tincture of Opium (♏v. to x.).

Again, Ergot in large doses, or introduced by intramuscular injection, but repeated not quite so often as in the more active hæmorrhage, is of great use. The time-honoured combination of Acetate of Lead and Opium in the pill of the B.P., Pil. Plumbi c. Opio (gr. v.), and the more modern Haseline, and many other drugs which have been from time to time recommended, are not, in our opinion, nearly so effective as Ergot in pulmonary hæmorrhage; but the drug must be given in large doses and frequently. It must, however, be acknowledged that there are some cases in which no drug appears to have the slightest curative effect. In such cases hæmorrhage ceases as it began, spontaneously. In some instances these apparently incurable bleedings give way to full doses of mercury, and it is, therefore, assumed that their cause is of syphilitic origin. They are rare cases. In this class, too, calcium salts may be tried.

We think the use of turpentine in all cases of hæmoptysis, except the most severe or gushing form (and even in that after the first violence has subsided), is worthy of great attention. It is a remedy which has passed into the category of "good remedies out of fashion." There have been many well authenticated cases in which turpentine has been successful in checking hæmorrhage after many other drugs have failed. It may be prescribed in the following form:—

℞ Olei Terebinthinæ, ♏xxx. (to xl. or more).
Mucilaginis Acaciæ, ʒii.
Aquam Carui, ad unciam.

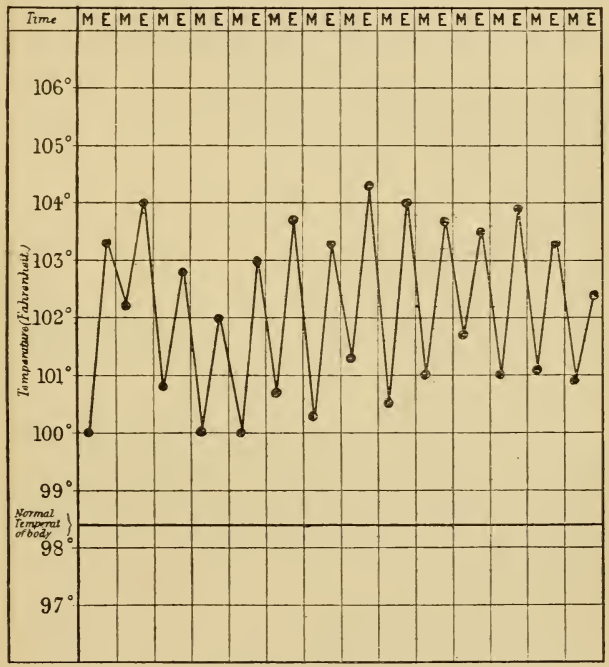
to be given four or more times in the day.

Even slight hæmoptysis, although never of itself very serious, requires care, lest by neglect it should take on a more acute form. Thus a patient who spits blood which is derived from the lungs should be directed to keep very quiet, should be prevented from indulging in anything but slop food, and should be briskly purged with sulphate of magnesia or similar saline. It is seldom necessary to administer hæmostatic drugs, but *counter irritation* in the form of lin. iodi or of a small blister over the seat of the most recent lesion may often be used with advantage.

In cases when it is doubtful whether the blood proceeds from the lungs or not, care should be taken to examine all other possible sources of the hæmorrhage, and a thorough examination of the pharynx and larynx should be undertaken, as well as of the posterior nares. Unexpected lesions in one or other of these regions may occasionally be discovered.

Pyrexia.—The range of the temperature during the progress of active tubercular disease is one of the most important indications which we have of the activity or subsidence of the specific morbid process. It is especially the day temperature by which this indication is given. In many stages of the disease a greater or less rise of temperature takes place at night, but in the large majority of chronic cases the day temperature is either about normal or below it. In the presence of active disease, however, the day temperature rarely touches or even approaches the normal line. Fluctuations take place in every twenty-four hours, but the lowest temperature recorded is febrile. The higher the day temperature the more active is the tubercular disease, except in a few instances (the so-called "*reversed type*") where the ordinary fluctuations are reversed and the night temperature remains the lowest throughout the whole course

of the disease. But whether the normal or the inverted remissions take place, the lowest temperature is always high, and so long as it follows this course, it may safely be assumed that active deposit of tubercle is taking place, even though the physical signs remain for the time unaltered.

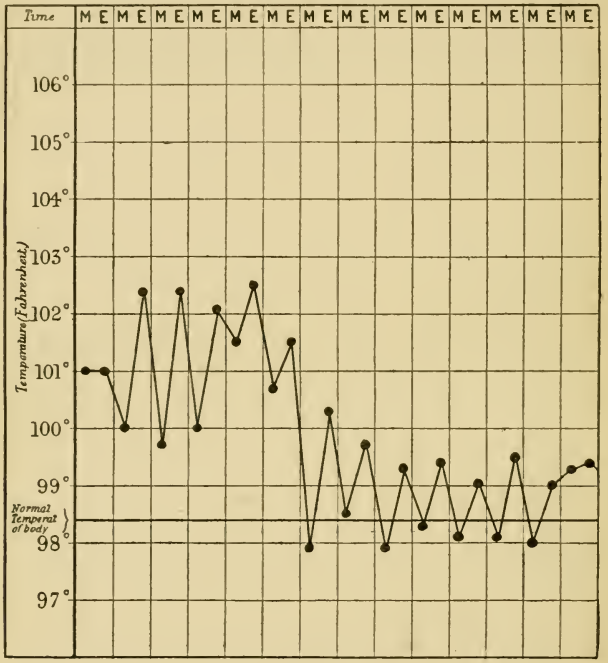


Type 1.

The accompanying chart of the temperature in the case of a carman, aged 25, with active and progressive disease, may be taken as typical.

With subsidence of the activity of the morbid process a

change may be noticed in the type of the temperature as shown in the next chart (2); the patient at first presented the common symptoms of active disease, but as these subsided, the temperature sank to normal in the daytime, although rising constantly at night. A clear distinction

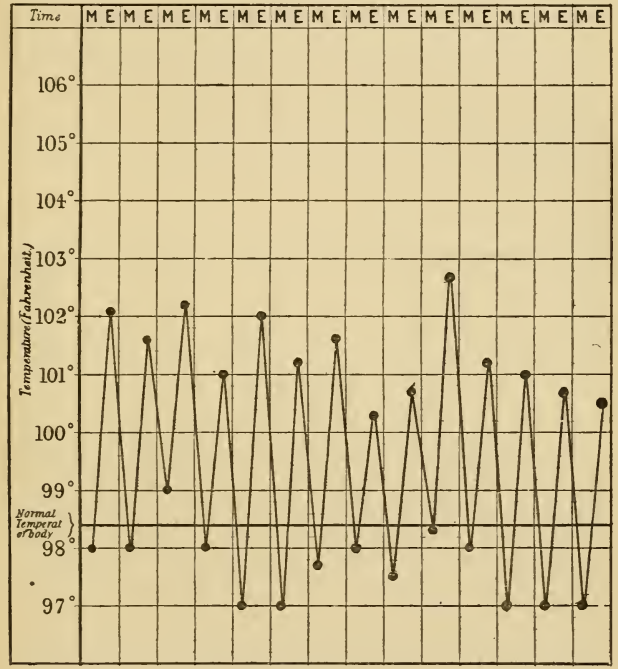


Type 2.

must be made between the symptoms of the presence of tubercle and the symptoms of activity of the morbid process.

Tubercular deposit may be present in large quantities within the lungs without causing a rise of temperature. In other words, the morbid process is quiescent and no

morbid chemical action is set up, and hence no systemic poisoning. Bacilli may be found in large numbers in the sputum of patients with disintegrating tubercle in their lungs, and still no marked rise of temperature may take place; the disintegrating tissue and the bacilli enclosed in it being alike effete. But a secondary series of changes

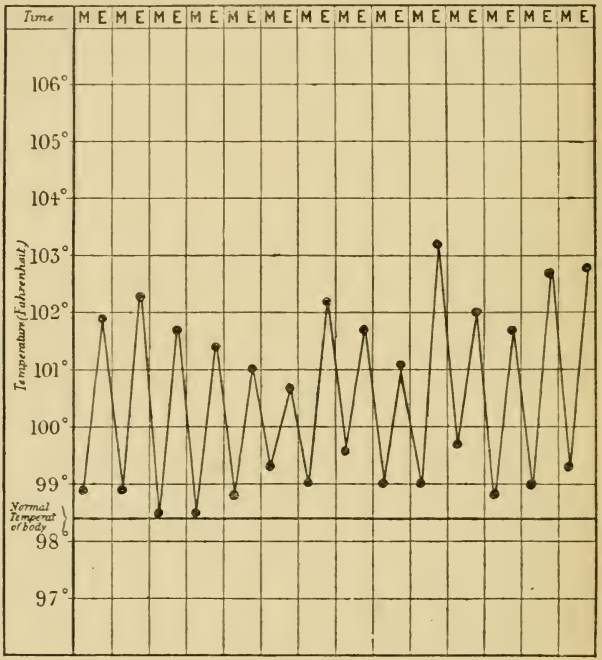


Type 3.

is set up in the passages through which the disintegrated tissue must pass and irritation is produced, followed by more or less inflammation. Sometimes this irritation may give rise to symptoms of systemic poisoning, and a considerable rise of evening temperature follows, but the

day temperature remains low. It is probable that in such cases the systemic poisoning is due to some of the pus-producing organisms, but it is only by the course of the day temperature that we are enabled to tell approximately which cause is at work.

Chart 3 is that of a case of advanced chronic disease,

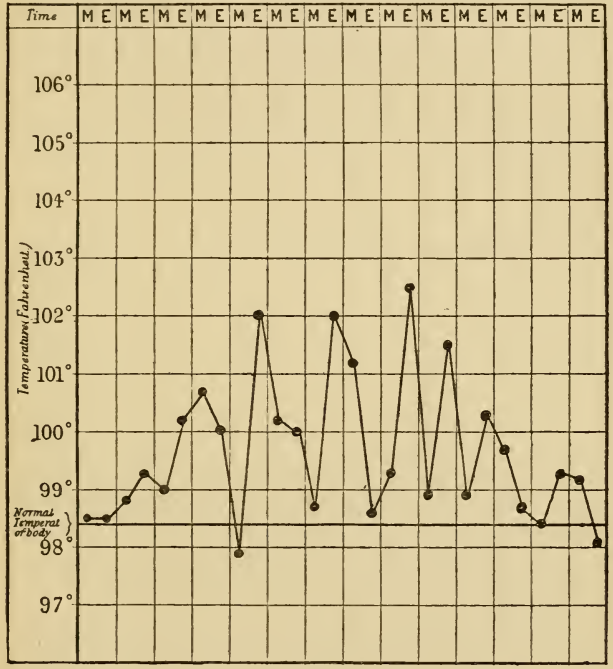


Type 4.

with cavities and excessive sputa, containing quantities of bacilli. Notwithstanding the constant nocturnal fever, the patient gained weight, and presented no symptoms of active tubercular disease.

This type of chart (3) is the most commonly met with in cases of phthisis where destruction of the lung has taken

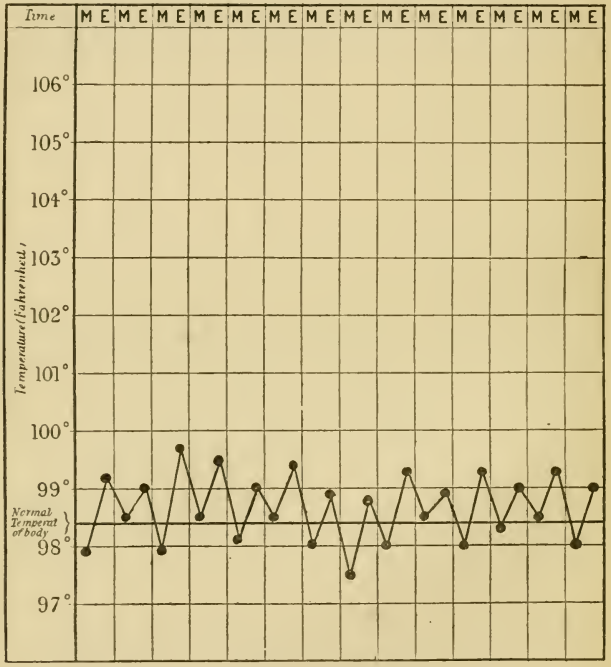
place and continued slow disintegration of tissue is in progress. But in many cases the night temperature is lower. The height to which the night temperature rises is often of importance in the prognosis of these cases. Roughly speaking, the higher it rise the less probability is there that the destructive process is becoming arrested.



Type 5.

It is a noteworthy fact, however, that in these cases of high or moderate rise of temperature at night, a steady gain of weight may be maintained. This is rarely the case when the day temperature, as well as the night temperature, is above normal. In the case from which Chart 4 was taken, there was advanced chronic disease,

with cavitation and much expectoration of muco-pus, but no gain of weight and occasional sweating. It will be noted that the day temperature, although never high, was only occasionally normal. Disintegration of former tubercle was associated with the deposition of fresh deposit. Temporary activity of the tubercular



Type 6.

process and rapid subsidence may sometimes be exactly indicated by the course of the temperature. Chart 5 is a good example of such a case.

In very many cases, where no evidence of activity or extension of the tubercular disease can be made out, and

where the patient is able to follow a regular employment and feels well, there may be a constant slight rise of temperature, to which, as already stated, the patient may become habituated and which may be regarded as his normal condition (6).

Although the course of the temperature is thus a rough indication of the course of the disease, it must be remembered that other factors are at work in the production of pyrexia, in addition to the actual tubercular process. Chief amongst these must be placed the idiosyncrasies of the individual patient. It is a matter of common observation in other diseases just as much as in tubercle, that the amount of febrile reaction set up by similar agencies varies very considerably in different individuals. A common cold may cause a rise of temperature in one member of a family, while others show no febrile reaction whatever, even though from other symptoms it may be inferred that they are subject to the same, if not a more intense degree of catarrh or infection. This difference of individual reaction must be taken into account in dealing with consumption, and the absence of high temperature must not be regarded as a wholly favourable symptom if other symptoms of active disease are present. Thus it may happen in the course of rapid tuberculization that the day temperature is very low, never rising above 97·5° F., while the night temperature rarely exceeds 101° F. Wasting, sweating, anorexia, and perhaps diarrhœa, may all be present, and the patient may die with a low temperature. These are, as a rule, the cases in which the disease has lasted for many years, and in which the destruction of the lung has been extreme, but in all stages of the active disease cases may be met with in which the indications of the temperature chart are equivocal, and hence must not be too closely

regarded if other symptoms point to different conclusions.

The diagnostic value of the temperature during the active stages may be roughly summed up as follows:—

1. If the day temperature is high, never touching the normal and accompanied by a rise of two or three degrees each night, it is probable that acute miliary deposit is in progress and that the system generally is being influenced by the poison engendered by such acute deposit.

2. If the day temperature is regular, sometimes normal and sometimes ranging between 99° F. and 100° F. or higher, but always attended by a nightly rise, it may be inferred that slow and inactive deposit of tubercle is going on side by side with disintegration of former deposit, but that the system is not being much influenced by tubercular poison. Hence a general improvement and a gain of weight may be observed, so long as the night temperature remains at 101 or 101·5° F., but if it rises above these points such improvement is uncommon.

3. If the day temperature be constantly normal or slightly subnormal, and the nightly rise does not exceed 100° F. or 101° F., it may be inferred that the tubercular process is proceeding very slowly, if it be not actually quiescent.

4. If the day temperature is always normal and the nightly rise does not exceed 99·5° F., it may be inferred that the tubercular process is quiescent.

The concomitant processes of scattered inflammation and perhaps suppuration, the presence, more or less accidental, of pyogenic organisms of varying virulence, have all to be taken into account in estimating the value of the temperature chart in phthisis, but as a basis of observation the foregoing summary has often proved useful, both in diagnosis and prognosis.

From the clinical standpoint, then, the minimum temperature is no doubt of more real importance than the maximum, as a guide to the presence of an extension of the tubercular disease. The height of the maximum registration is, however, of value as giving us an idea of the amount of septic infection which is taking place. It is only necessary to take active steps to reduce the temperature when the patient is obviously actually suffering from it, that is to say when he is restless, irritable, and unable to sleep soundly or when sweating, wasting, and loss of appetite are marked. Under such circumstances no half measures are of much use; the mere administration of antipyretic drugs is of little value. The patient should be treated as though he were suffering from an acute inflammatory disease such as acute pneumonia. He should be kept in bed all day, and should be fed almost entirely upon slop diet, such as milk, beef-tea, extracts of meat, broth and soup, and should have a liberal allowance of alcohol in some form or other, *e.g.*, brandy, whisky, or other spirit, or good wine, and together with this treatment he may have Quinine administered in five or seven-grain doses until he shall have taken altogether about a drachm of that drug; several doses of ten grains at short intervals may possibly be sometimes more efficacious, but it is seldom if ever advisable to persist with the medicine if the temperature does not show a distinct fall in a few days. If, however, there is such a fall it is well to continue the drug, but in smaller doses. Very much the same may be said of Antipyrin; this may be given in five-grain doses or even in larger amounts three times a day, but if there is no decided effect after three days it is best to discontinue its use. The somewhat erratic drug Antifebrin may occasionally be tried with good effect, as may also

on occasion Phenacetin, and similar drugs. Our experience of Salicylate of Sodium in twenty-grain doses repeated three or four times in the twenty-four hours certainly bears out that of others that it sometimes acts as an antipyretic in cases where other drugs administered for that purpose fail. We cannot, however, from a mere examination of the temperature chart, decide beforehand whether or not antipyretic drugs are going to be useful, and it would be mere folly to make such a statement. The exact time when antipyretic drugs should be given is worth specifying. It is the hour, no doubt varying in each case, when the evening temperature, as shown by the chart, usually begins to rise. It should be remembered, however, that many cases occur when the antipyretic drugs are found of no effect, and under such circumstances very little reliance can be placed on the trial of the many new drugs which are being constantly introduced as superior to the old antipyretics at hand. We must concentrate our efforts upon the maintenance of the functional activity of the various organs and the relief of any symptom, short of the actual pyrexia, which is pressing. The use of ice, or of cold sponging and bathing, although possibly of temporary benefit, is not to be recommended as a rule, since if they are apt to give rise to the fear as well as the risk of a "chill." It is necessary to bear in mind that consumptive patients do not actually suffer from the high fever which may be present to anything like the same extent as patients with pneumonia or typhoid fever with the same maximum temperature. It therefore follows that the reduction of fever by mechanical means does not carry with it the same sense of relief. It is also unlikely that the maximum temperature continues so long at a time as in those other fevers. In cases in which fever is combined

with night or sleep sweats, the practice of sponging the surface with lukewarm water to which a small amount of vinegar or Eau de Cologne has been added, according to the wishes of the patient, is often exceedingly grateful, and not unfrequently, at any rate to a certain extent, checks both the one and the other symptom. It has been found that with the active administration of Creasote, cases sometimes occur in which marked reduction in the range and in the maximum of the temperature has been noted. No doubt such cases are rare, but their occurrence deserves mention, although we should hesitate at the present time to place Creasote in the ranks of antipyretic drugs.

Sweating.—Sweating to an excessive degree is often met with in phthisis. In some cases it is one of the earliest symptoms, and coupled with wasting may be looked upon as highly suggestive of the disease. It is not, however, a symptom of early phthisis only, but may occur at any stage of the tubercular affection, and often accompanies the chronic form to a greater or lesser extent. It is looked upon by some as an almost necessary accompaniment of fever whenever that appears in the course of the affection. This, however, is somewhat too sweeping an assertion. It is true that the relationship of fever and sweating is an intimate one, but the amount of the sweating is by no means directly in proportion to the amount of the fever. Thus we see that in early phthisis, almost before there is any other marked sign of the tubercular disease of the lung, and when the fever is very slight, the sweating may be so profuse as to induce the patient to apply for medical advice simply to obtain relief from it. Again, in the chronic disease, when the fever is also of a mild type, the sweating may continue and may be very excessive. In the majority of cases, ac-

cording to our own observations, the most marked cases of sweating are those in which the fever is of a high degree, and if by any means the fever is reduced, the sweating is at the same time diminished or even stopped, but the contrary is not true, since it is quite possible to reduce the sweating by the use of drugs without producing any appreciable diminution of the fever. In all probability if we were able to examine carefully into the cases of sweating, we should find that different physiological causes are at work.

It has been shown that in the causation of sweating normally, two factors enter: first, direct secretion by the cells of the sweat glands of the skin, the control of which, both in the direction of stimulation and also of inhibition, is held by the central nervous system, in which—both in bulb and spinal cord—are contained sweat centres; and secondly from an increased supply of blood to these glands, since when the superficial blood-vessels are dilated, the glands secrete more freely. The condition of the superficial vessels is of course also under control of the central nervous system—the vaso-motor centres in the bulb and cord. In addition, however, to the centric control it is probable that the glands may be locally stimulated as by application of heat to the skin, which also dilates the superficial vessels. In the excessive sweating of phthisis it is probable that the cause is at one time referable more to one of these factors than to the other. The relation of sweating to high temperature, too, is doubtless complex.

First, sweating may be the result of the fever, the fever producing its effect by—*a*. Stimulation of the centres in the bulb or spinal cord which govern the output of the sudoriferous glands; *b*. By stimulation of the vaso-motor centres in the bulb and cord to produce dilatation of the cutaneous vessels; or *c*. By stimulation of the sweat

glands or blood-vessels locally to cause hypersecretion. Secondly, fever and sweating may be both due to the same cause, viz., a poisoning of the nerve-centres (sweat, vaso-motor, and heat) by the same poison, viz., the tubercular toxins. Thirdly, we may have the sweat-centres, or perhaps the sweat-glands, stimulated independently of the heat and vaso-motor centres, as when the surface of the body is cool and the internal temperature is not raised. Of course to dogmatize as to the exact cause in any given case of sweating would be unwise, but considering the conditions which surround the various stages of phthisis it is not unreasonable to suppose that in the early stage of the disease we have the second set of conditions acting, in the late stage the third set, and in the usual course of the disease, *i.e.*, the intermediate period, the first set of physiological conditions most pronounced. Our experience of the use of the different remedies which have been recommended to check the sweating strongly supports the idea that the conditions of sweating in different cases are not the same, since sometimes a drug like atropine, which is highly efficacious in many cases, fails utterly to produce the effect expected of it, whereas another drug like oxide of zinc acts well. The influence of atropine has been proved to be exerted upon the secreting apparatus itself, whereas the other drug acts simply as an astringent to the blood-vessels. Many similar examples could be given in support of this idea. Again, as to the question whether it is right to check night sweats in this disease. Next to blood-spitting there is scarcely a symptom which has such a markedly depressing effect upon the patient as sweating. After an excessive sweat the patient is as a rule utterly used up. He seems quite unable to exert himself, and moreover experiences great depression of spirits lasting

for several hours. He looks forward to sleep with anxiety, as he knows by experience that the sweating mostly occurs whilst he is asleep. Again, after the sweat he is almost always obliged to lie for hours in damp or even wet sheets, whilst the heat of his body causes a considerable amount of vapour to be generated about him, so that he is not only in a damp bed, but also, as it were, in a vapour bath for long periods. This must add both to his discomfort as well as to the general weakening effect of the sweating. On the other hand it must be admitted that when fever is present the result of the sweating is to cause a distinct lowering of the temperature, sometimes to the extent of two or three degrees.[1] This reduction of the temperature is, we believe, bought at too great a cost, and in our opinion the sweating, if excessive, should always be checked. We have never seen any apparent

[1] The following notes illustrate the conditions under which sweating of very marked degree takes place in cases of established phthisis:—

Arthur N., æt. 27. Range of daily temperature—Morning, 97° to 98°; evening, 100° to 101°. Sweating, lasting from midnight to 3.40 a.m., noticed to be excessive on chest, considerable on face, back, and arms, and only slight on legs. Temperature before the sweating commenced 100°, during the sweating 98·6°, and after the sweating was over 97·6°.

Alfred M., æt. 20. Range of temperature 97° a.m. to 101° or 102° in evening. Sweating attacks lasting about half-an-hour from 12.30 a.m. chiefly on chest, but also on face, axillæ, back, arms, and legs. Temperature before attack 101°, during 98·7°, and after 97°.

Mary A. B., æt. 19. Range of daily temperature 97°-98° a.m. to 102°-103° evening. Attacks commencing about 10.45 p.m., lasting about a quarter-of-an-hour. Temperature before sweating 101, during the attack the same, and after 100°. Sweats excessive on face and axillæ, but considerable on chest, back, and arms; slight on legs.

Alfred K., æt. 38. Range of daily temperature from 97° a.m. to 100° p.m. Attack beginning about one a.m. and lasting half-an-hour. Excessive on back, axillæ, and face, considerable on arms, and slight on chest and legs. Temperature before attack 98°, and after 97°. (Notes supplied by Dr. Fish, House Physician).

ill-effect produced by this procedure, and so do not sympathize with the fears of some physicians that by checking the sweating we hasten the end, even in very advanced cases. Of course when a patient is actually dying no sensible practitioner would try and treat symptoms simply for the sake of doing something, and in such circumstances only general stimulant treatment should be attempted.

Sweating, therefore, should be stopped if it be excessive, and bearing in mind the conditions which produce it the following suggestions may serve to indicate the best methods of treatment. First, if there is marked fever present, we should, if possible, try and reduce it. For this purpose we may adopt the methods which have been already discussed under the head of Pyrexia. To these we need not return, but would briefly mention that different authorities have placed great faith in quinine, salicylate of sodium, salicin, and antipyrin in this connection, not only to diminish fever, but also to check sweating. It is, however, a hard task to check for any length of time the fever of progressive phthisis, and very often we have to be content with checking the sweating independently of the fever. For this purpose many specific drugs (so-called) have been recommended. Of these we consider Atropine by far the most useful. It is generally given at bedtime, thus:—

℞ Atropinæ Sulphatis, gr. 1-100th, 1-75th, 1-50th.
In formâ pilulæ.

As the sweating which yields to atropine comes on in the early morning about three to four a.m., the drug would seem to have a prolonged paralyzing action upon the secreting cells or their nerves. As the patients are nearly always awakened by the sweating, and do not

sleep much after, it is obvious that the effect of this drug, and, indeed, of any other drug which checks sweating, has a beneficial effect in increasing the amount of sleep.

Atropine may also be given in the form of draught, to contain four minims of the Liquor Atropinæ Sulphatis (B.P.). Sometimes, too, it has been used as a subcutaneous injection, but in our experience it is most effective when given as a pill.

Some have suggested the employment of Belladonna for atropine, but given internally we have not obtained such striking effects from its use as in the case of its active principle.

Sometimes we are obliged to give up atropine because of the great sensitiveness of some patients to its action, dryness of the throat, and even dilatation of the pupils and loss of the power of accommodation having been observed from even small doses.

In such cases:—

Picrotoxin may be given in form of pill, made up with sugar of milk and glycerine of tragacanth, the dose of the drug being from gr. 1-100th to 1-50th. It may also be given in the form of a draught as the Liquor Picrotoxini Aceticus, of which 2 to 10 minims may be given in water.

Pilocarpin in small doses of 1-20th gr. in form of pill sometimes acts when atropine fails. It is usually given as the nitrate.

Agaricine, given in form of pill in doses of 1-12th gr. to 1-6th gr., which may be considerably increased if necessary without harm arising, even to 1 gr. If, however, given in large doses its purgative effect may be produced. This drug is highly successful in checking the night sweats in some cases which may have resisted the influence of atropine and other drugs. It should be given

several hours (six to eight) before the usual time of the commencement of the sweating.

The old-fashioned remedy, Aromatic Sulphuric Acid, in half-drachm doses at bedtime sometimes acts well, as does also the Oxide of Zinc (gr. ii. to iii.) or the Sulphate in form of pill.

It is unnecessary to mention the various other drugs which have been used with success in checking night-sweats. It is very seldom that one or other of those we have mentioned is not efficacious. In some cases it is recommended that the patient should be waked (if necessary) at some hour between 1 and 4 a.m., and should take a glass of wine, such as port, with a biscuit, or should have a good cupful of soup or beef-tea, warm and strong. Such a proceeding appears to be effectual for the purpose of checking the sweats even when specific drugs are not. In order to obviate the ill-effect of wet or damp clothes it has been suggested that the patients should be well rubbed dry with suitable flannel or other cloths. In cases of uncontrollable sweating it may be even necessary to provide a second bed to which the patient may be removed, provided with dry blankets and sheets. Careful rubbing or massage is often of considerable use in such cases.

CHAPTER X.

SPECIAL METHODS OF TREATMENT.

It would be out of the question to attempt in a book of the scope of the present volume to give an account of all of the various methods of treatment which have been suggested for the purpose of alleviating, arresting, or actually curing pulmonary tuberculosis. Their name is legion! Scarcely a month passes in which some such new or resuscitated method of treatment is not brought forward. All we propose to attempt is to give an account, more or less full, of the methods which have had either (*a*) more than an ephemeral existence, or (*b*) which have been introduced by standard authorities, or (*c*) which appear to have been justified either by theory or practice.

Let us begin, then, with an account of the treatment of the disease by means of *Antiseptic remedies.* This is, as we have shown in an earlier chapter (p. 96), an endeavour to destroy the tubercle bacillus after it has effected an entrance into the body. It depends upon the very simple principle of introducing into the body some of the drugs which have the properties of killing or of arresting the growth of micro-organisms outside the body. If such substances can be brought into contact with the bacilli of ubercle in sufficiently great amount, we might assume, *à priori*, that the disease would be arrested. Various plans have been suggested of attaining this object, and various drugs of antiseptic nature have been used. First of all the drugs are introduced by inhalation, that is

to say, the drugs are volatilized, and as such are inhaled into the lungs. If the drugs which have powerful antiseptic power could be by this means brought to the actual area of the disease in the lungs in sufficient strength, the plan would obviously be a most useful and hopeful way of stopping the activity of the tubercle bacilli. The second method of introducing antiseptic drugs is by means of the alimentary canal. Certain drugs are given by the mouth under the hope that if absorbed into the blood in sufficient amount, and if carried to the seat of the tubercular disease by means of the blood stream, they may act as germicides. The third method of introducing antiseptic drugs is by actual injection into the subcutaneous or into the intramuscular tissues. By this means it is hoped that a greater amount of the drug introduced may be absorbed, and more quickly, than by means of the alimentary canal.[1]

(*a*) **Of Inhalation Methods.**—The method of making patients suffering from consumption breathe an atmosphere of some gas or volatilized drug is by no means a recent introduction. It dates back far beyond the discovery by Koch of the specific nature of pulmonary tuberculosis. Not to go farther back than the time of Louis we find that in his day the inhalation of Chlorine gas was strongly recommended by good authorities as an actual cure of phthisis. Cases of cure were recorded, but the proportion of cures to cases in which the remedy was tried does not seem to have been very phenomenal. Louis and Bayle, who had seen the method tried in a good many cases, were not in favour of it. The method of treatment appeared to receive some support from the statement that people in the neighbourhood, or who actually worked in chlorine

[1] In dealing with the history of inhalation methods it is necessary to extend somewhat the account we have already given in Chapter II.

works, *e.g.*, near Glasgow, were not affected with pulmonary tuberculosis, and if affected were alleviated, if not cured. However, as is well known, these somewhat too general statements can seldom be substantiated if carefully inquired into. The method fell into disuse and has not been, so far, revived. From the extremely irritating nature of chlorine gas to the respiratory mucous membrane it would seem doubtful that it could be inhaled in sufficient strength to be of any use as a germicide. It is well known that chlorine gas in any greater proportion than 25 to 50 per cent. produces spasmodic closure of the glottis and is irrespirable.

Inhalations of Creasote and of Iodine were becoming fashionable in Louis' time, but the recorded cases were too few in number and too indefinitely described to be of much use as a criterion of the value of this kind of treatment in those days. It is evident, however, that the inhalation treatment just then was experiencing a considerable amount of favour, and in Laennec's classical work we find allusions to a variety of substances which had been employed in this form. It will be of interest to mention a few; the vapours of decoctions of plants of an emollient, aromatic, or narcotic nature (all of which would be far too weak to do more than exercise possibly a soothing influence upon the upper part of the respiratory mucous membrane), the fumes of different kinds of resin burned on a hot iron or in a brazier, particularly of myrrh, benzoin, petroleum, or tar. These substances if inhaled freely and for long periods might be expected to penetrate into the smaller air passages. Next the air of cow-houses, and the vapours produced by the sublimation of zinc, lead, and sulphur. The gases oxygen, hydrogen, sulphuretted hydrogen, carbonic acid, and the like. In spite of the support which this method of treatment received from the general

public, or perhaps one should say from fashion at that day, Laennec[1] could not be led to believe in the good which was stated, and stated by competent physicians, to accrue from the treatment of phthisis by inhalation. He summarized the records most unfavourably. It is possible that he was somewhat biassed against this plan of treating phthisis by his view of the pathology of the disease. At any rate it is a fact that in spite of his disapproval, and the disapproval of many of his followers in the years that ensued, inhalation treatment increased in favour, and this was particularly the case after the revolution in the pathology of phthisis brought about by the views of F. v. Niemeyer, to which attention has already been directed. As an indication of this fact we may take the report of Dr. Jules Cheron, who was physician to the Hôpital St. Lazare in Paris, and who systematically devoted himself to the trial of the inhalation method ("Gazette Hebdominaire," December 30th, 1872). He concluded that pulmonary cavities treated with such "oxygenated essences" as Japan camphor, camomile, cedar, and eucalyptin, cicatrize in a great number of instances and in

[1] The belief in the protective or even curative value of certain vapours, such as peat smoke, chlorine, creasote, and other gases which may be inhaled in the neighbourhood of chemical works, is even at the present time sufficiently strong to cause consumptives to alter their place of dwelling and mode of life in order to bring themselves within reach of them. In many instances, however, this faith has arisen from the tradition that consumption does not occur in such places. That this argument is untrustworthy we have already seen. Phthisis may frequently be found to be prevalent in one district whilst the neighbouring districts are much less affected, although the conditions are apparently identical, and in the same way the distribution of tubercular disease in chemical and other factories is altogether irregular. There can be little doubt, however, that material benefit is sometimes derived from prolonged and continuous inhalation of an atmosphere heavily charged with one or other of these fumes.

a short time. He found by experiment that the method of treatment was most useful in chronic forms of phthisis, diminishing the expectoration, the dyspnœa and cough, increasing the appetite and strength, preventing fever, and in many cases allowing of the complete recovery of the patient so treated. When these researches were published the opinion no doubt was gaining ground of the specific nature of tubercle; its inoculability had been shown. Klebs' supposed discovery of the specific micro-organism was premature, but was important from one point of view, viz., that a new method of antiseptic inhalation treatment was founded upon it:—Benzoate of Sodium was administered in the form of a spray; 2 % to 3 % solution of the drug in distilled water being used. The patient was supposed to inhale no less than a pint of a 5 % solution, diluted if necessary, per diem. This method was not very extensively tried, nor was it very successful. The theory of its use, however, was certainly a sound one.

Not to delay further in tracing the rise of inhalation treatment in the cure of phthisis, we will next turn to the ways of employing volatilized substances as inhalations.[1] There are two chief ways now in vogue, viz.:

[1] Inhalation of medicated steam at a temperature of 140° F. is best carried out by placing the volatile substance in a jug or one of the many forms of inhaler with about a pint of water at a temperature of 160° F. The mixture is then well shaken and the steam as it arises and carries with it the volatilized drug is inhaled either through the mouth or through both mouth and nose, in a way which has been already described. Care must be taken, when using an inhaler with a mouth-piece only, to keep the nose closed. Those inhalers which are made so that the air bubbles through the water are to be preferred. Of these, the so-called "Eclectic Inhaler" devised by the late Sir Morell Mackenzie is the best. Inhalations by this method should not be prescribed for use more than two or three times a day, and after each sitting the patient should

(1) The inhalation of steam medicated by the addition of the volatile substance into the hot water from which it is

remain for a quarter of an hour in the same room. Acutely inflamed conditions both of the pharynx and larynx are often much relieved by this form of treatment, and it should only be used with this object. Hence the antiseptic drugs are less suited for administration in this way than the balsamic preparations. The old-fashioned "Friar's Balsam," or Compound Tincture of Benzoin, as it is now called, is the most suitable in all such conditions. The temporary sore throats often depending upon slight patchy pharyngitis, the early condition of acute laryngitis, giving rise to soreness in the larynx, partial loss of voice, and dysphonia, are soothed and relieved by the simple Vapor Benzoini more than by any other method of treatment. The dose of the compound tincture of benzoin should be about a teaspoonful to a pint of hot water. In cases of bronchial irritation with much secretion this plan is also of service, but an extremely good result can also be obtained from the inhalation of simple steam. In certain irritable conditions of pharynx and larynx unattended by visible inflammation the inhalation of Vapor Iodi of the B.P. or of the Vapor Acidi Carbolici or of Liquor Carbonis Detergens will sometimes be found of service. All of these drugs, however, are intended for the relief of temporary local irritation, and hence do not require to be often repeated or continued for any length of time as is the case with the "instillations" where actual absorption of the drug is desired.

Medicated sprays, whether administered by a hand ball apparatus or by Ziegle's steam atomizer, are chiefly of value in dealing with the more chronic and inflammatory conditions of the pharynx and larynx in the course of phthisis. They require special care in administration, but if skilfully managed are very valuable adjuncts to palliative treatment. A glass bell-mouth collecting tube is an essential part of the apparatus, and this should be used in the following way. The bell-mouthed end of the tube should be turned towards the inhaler and not towards the patient. The other end of the tube should be taken into the widely-opened mouth, resting upon the tongue as far back as the patient can tolerate it. The lips should then be closed firmly over the outside of the tube and the patient should be directed to close the nostrils with one hand and to breathe freely and deeply through the tube. The current of steam arising from the atomizer and containing the drug which it is desired to exhibit should be directed through the tube while the

derived.[1] The modified methods of inhalation of a drug by means of a ball spray or of a stronger solution of a drug atomized by means of a steam atomizer, the drug being further diluted by the steam from the apparatus, are methods only adapted for the relief of local inflammatory or irritable conditions of the upper air-passages. The success or failure of treatment by means of the ordinary method of inhalation largely depend upon the care and intelligence which are bestowed upon the effective manner of carrying it out. In the first place any patient who is about to use inhalation for the first time should be directed how to breathe deeply through the mouth without using the nose. This is not so essential in the case of the oro-nasal inhaler, but even with that it is still an object to be aimed at. Before using any of the other kinds of inhaler the patient should be instructed how to open the mouth widely and to depress the tongue. Until he has learned how to open the mouth in such a way as to enable the reflection of the back wall of the pharynx to be visible in a mirror, it is of little use for him to attempt the use of an inhaler. Having, however, attained this accomplishment, he must then be told how to take a deep breath without moving his tongue, and this must also be practised before a looking-glass. The position in which the patient sits to practise the inhalation method is also of importance, particularly in the

patient inhales and expires freely three or four times. A pause should then be made and the process repeated about five or six times at a sitting. This method, if intelligently carried out, ensures the distribution of the dilute solution of the drug over the whole surface of the pharynx and larynx and sometimes of the upper part of the trachea also when toleration has been established in the larynx.

This is hardly more than a local method of treatment of the pharynx and larynx, and is only placed among so-called antiseptic methods for the sake of convenience.

ase of steam inhalations. The body should be fairly upright and the head slightly raised, so as to render the angle formed by the mouth and the trachea as obtuse as possible. Inhalations of medicated spray should not be continued for a long time without some pauses for the respiration of fresh air. Four or five inspirations of the drug should be followed by a sufficient pause. It should be recollected that one or two deep inspirations are equal n their effect to a much larger number of shallower and more rapid breaths. Each sitting, inclusive of the pauses, should not exceed a quarter of an hour. (2) The second method of inhalation, viz., that of continued inhalation of medicated vapours, is best effected by means of the naso-oral respirator. The drug or drugs to be volatilized are placed upon the sponge of the respirator, so that the air passing into the lung is impregnated with the vapour, which it is desired shall have access to the diseased area of the lung. This plan, in order to distinguish it from the ordinary plan of inhalation with steam, is called "Instillation." It has been much used, and is now generally regarded as part of the routine treatment of consumption. That this is the case is due to the favourable opinions upon the method which have been given by those particularly engaged in the treatment of the disease. Of these we may for example mention a few, viz., Dr. Coghill (of Ventnor), who was the first to render the method popular, Dr. Burney Yeo, and Dr. Thorowgood.

The first respirator used with this method of treatment was of simple form, adapted to cover the mouth only, with a double bottom of perforated metal and elastic cords to fasten over the ears. The space between the metal plates was filled with tow saturated with the antiseptic solution. Instead of this form of respirator one much easier to use was introduced by Yeo, and is a naso-oral

respirator; it is made with perforated zinc, and may be constructed for a few pence. A piece of sponge or some cotton wool is arranged so that the dissolved antiseptic may be placed upon it.

Of this method of so-called "instillation" we have had much experience at the Victoria Park Hospital, and we have employed many drugs and combinations of drugs as substances to be inhaled. Of these we may mention a few:—Pure Beechwood Creasote, Terebine, Eucalyptus Oil, Ol. Pini Sylvestris, and others.

The material we have found most useful is either pure Creasote or the following mixture; it is a little difficult to make:—

℞ Olei Eucalypti, 10 ccm.
Chloroformi, 2 ccm.
Iodoformi, grm. i.
Spirit. Vini rectif., 10 ccm.

About thirty drops are used at each sitting. The patient should use the respirator at least three times a day, half-an-hour at a time. A very similar formula, which is used in the same manner, is the following:—

℞ Thymoli, grm. ii.
Camphoræ, grm. ii.
Acidi Carbolici, 2 ccm.
Olei Eucalypti, 10 ccm
Spirit Vini Rect., 20 ccm.

The following is also a good form of antiseptic when the patient is able to endure the irritation of the air-passages which it frequently sets up:—

℞ Acidi Sulphurosi, 10 ccm.
Acidi Carbolici, 5 ccm.
Aquæ Destill., 85 ccm.

Whenever Creasote, Ol. Pini Sylvestris, or Eucalyptus

Oil is used it is better to mix with the drug an equal quantity of pure spirit.

The obvious criticism of this method of attempted introduction of antiseptics into the lungs is, first, that even if the volatile drug penetrates into the ultimate air sacs—which is possible—it cannot penetrate into solid tissue or into tissue rendered solid by tubercle. The second objection is that the drug, even if it should come in contact with the microbes in the diseased area, would not be sufficiently concentrated to produce a germicide effect. If, therefore, this mode of treatment is suggested as a cure for the disease, it is one upon which little reliance can be placed; if, however, it is used as palliative treatment the above criticism is not so crushing. According to our experience under its use cough and expectoration are less marked, the fever is often reduced, the patient sleeps better, has a better appetite, and so in the majority of cases gains weight. It is particularly useful in cases of chronic phthisis with extensive vomicæ. It is a matter of common experience that in the contents of vomicæ many varieties of micro-organisms exist, and among them are often those which set up decomposition. It is possibly upon these bacteria that the diluted antiseptic drug acts, and so the vomicæ are kept sweet, and the after-effects of the absorption of the products of decomposition are less evident.

Much might have been expected, on first principles, from a third form in which the inhalation method has been tried, viz., by keeping patients for longer or shorter times in a chamber in which strong antiseptics are being vaporized. Several attempts in this direction have been tried. Thus, some ten years ago our colleague, Dr. Heron, turned one of his small wards in the hospital into a *Carbolic Acid Chamber*, in which carbolic acid was con-

stantly being vaporized. In this chamber the consumptive patients lived for the chief part, if not the whole, of the day and night. In spite of the excellence of the principle upon which this treatment was based, Dr. Heron reported that no marked good could be traced to its use. Latterly, another of our colleagues, Dr. Arnold Chaplin, has instituted a *Creasote Chamber*, in which crude coal tar creasote is boiled over a spirit lamp. Into this chamber patients are introduced daily for a longer or shorter time. Under such conditions there can be no doubt that much of the vapour is inhaled. At first the fumes are decidedly irritating to the mucous membranes, but after a time tolerance is established. Having seen some of the results from the use of this chamber we are able to speak hopefully of it in certain cases, especially in those in which there is excessive secretion, as in cases of chronic fibroid phthisis and in bronchiectasis. At any rate, Dr. Chaplin has been encouraged by the goodness of his results to persevere with the method.[1]

eport upon the Treatment of Phthisical Patients in the "Creasote Chamber" (Dr. Arnold Chaplin). Number of cases treated 15.

Nature of cure.—Most of them were early cases of Phthisis, in which but one lung was involved. Though early cases were chosen, yet care was taken that the lesion in the lung was active, as evidenced by sweating, hectic temperature, and wasting.

Method of application of the treatment.—Common commercial coal tar creasote was used. A small chamber, about eight feet square, was fitted up and made somewhat air-tight. In the centre of this chamber was placed a small open dish, half filled with Creasote. A spirit lamp was placed under the dish, and the fumes thus generated from the Creasote soon filled the room. The patients sat in this atmosphere of Creasote, which they could not help inhaling, for a period of one hour every day. These sittings continued daily for six weeks.

Results immediate.—The patients generally expressed themselves as feeling lighter and freer in the chest. The phlegm came up more easily. The lessening of the Dyspnœa was a marked feature. Many

Without devoting more time to the further consideration of the antiseptic inhalations, we will pass on to the treatment by means of the Inhalation of Hot Air which was suggested some years ago in Germany. The hot air must be considered to be an antiseptic and to take the place of medicated vapours. The idea of treatment upon this plan was based upon the knowledge that in cultures of the tubercle bacillus outside the body, a heat a little above that of the body kills the micro-organism. It was assumed, therefore, that if air could be introduced into the lungs at a temperature sufficiently high it would kill or put a stop to the growth of the bacilli. For the purpose of introducing the heated air into the lungs, various apparatus were designed, and the treatment was warmly advocated by Weigert ("Die Heissluft-Behandlung der Lungentuberculose," Berlin, 1889), Mosso and Rondelli ("Einathmung auf 200 grad. erhitzer Luft," "Deutsch. Med. Wochenschr," No. 21, 1889), Haller ("Berl. klin. Wochenschr.," Sept., 1888), Sears ("Boston Medical and Surgical Journal," cxxi., 1889), and others. This method of treatment has passed through the usual stages; at first it was highly lauded, then as strongly condemned, and has now fallen into disuse. It was tried somewhat extensively

patients were able to ascend stairs which before were insurmountable. The sweating and hectic temperature were certainly controlled in almost every case, the sweating improved, and the temperature fell. Not much effect was produced upon the body weight, but the patients generally expressed themselves as eating better, and as feeling generally improved.

Remote effects.—After a time all the patients fell back into the old state of ill health and at a distance of six to twelve months appeared to be benefited not at all.

Dangers.—None. No hæmoptysis or bronchitis followed the inhalations, as might have been supposed from the irritating effects of the inhalation.

on the Continent as well as in England and America. For a very complete history of the treatment, a critical summary of its effects, and an experimental demonstration of its fallacy, we are indebted to Prof. Gilman Thompson, of New York ("New York Medical Record," Vol. xxxvii., No. 17, p. 457, *et seq.*). His conclusions were as follows: (1) That continuous inhalation of air heated from 200° to 300° F. at the nose does not raise the temperature of the lungs at all, in some cases, even when the duration of the inhalation is an hour or more. (2) That in other cases, if it be continued for an hour or more, there may be a slight rise from 2 to 4 degrees F., due to various causes other than the entrance of hot air into the pulmonary alveoli. (3) The temperature of the trachea under corresponding conditions rises only 4 to 7 degrees F.

Cold air does not affect the temperature of the trachea or lungs any more than hot air, and is, therefore, equally useless as an inhalation for any clinical purpose whatever.

The inhalation of *Hot Moist Air* has in like manner been tried, and in turn rejected. Its effects were supposed to be to create an artificial excess of moisture within the lung, such a condition being thought likely to check the reproductive activity of the bacillus. Six patients were treated by this method for several weeks in the year 1889 at the Victoria Park Hospital, but no desirable results ensued, except an increase in the amount of the expectoration and the ease of bringing it up, but in two cases with considerable bronchial irritation.

Inhalation of *Oxygen*, although to a certain extent in vogue in the treatment of acute pneumonia, has been tried in phthisis without effect, and the same observation is true of the *breathing of compressed air*, which has been subjected to careful trial. Lastly, in connection with the

introduction of drugs and gases into the air-passages, it is necessary to mention the somewhat peculiar method suggested by Cantani ("Versuch einer Bakteriotherap.," "Centralblatt f. d. Med. Wiss.," 1885, No. 29, p. 513), the introduction into the lungs by means of a spray apparatus of solutions containing *Putrefactive Bacteria*, under the idea that as the putrefactive micro-organisms increase the tubercle bacilli diminish, and are at last crowded out. The bacteria which were used consisted of pure cultures of the so-called bacterium termo.[1] In the hands of its introducer a certain amount of success was attained, and sometimes tubercle bacilli were said to have disappeared from the sputum. Improvement in cases treated after this manner were reported by Fuckel ("Allg. Med. Central Zeit.," 1885, No. 61, p. 973), Salama ("Riforma Medica," 1885, 14, viii., ref. "Gazz. degli Ospitali," No. 68, p. 542), and others, but these successes were followed by a long train of failures, and many observers reported against the practice, and called in question the theory upon which it was based. Experiments also with rabbits and guinea-pigs gave negative results.

he next division of the subject of the Antiseptic Treatment of Phthisis is (2) the *method of introducing antiseptic drugs by means of the alimentary canal.* Certain substances are given by the mouth or are injected by the rectum with the idea that they may be absorbed into the blood current, and may so be brought to bear upon the foci of disease in the lung. Many of such drugs have been tried from time to time, but unfortunately in the vast majority of cases with no apparent curative effect. If an exception may be made to this generalization we are inclined to make it in favour of Creasote, and of the

[1] A most comprehensive class of micro-organisms.

so-called essential principles derived from it, of which the most important is the Guaiacol.

Of other drugs which may be considered as germicide in sufficiently large doses, of which we have ourselves had experience, we may briefly mention several, viz. :—Helenine, Tar, Mercuric Chloride, Periodates, and Iodoform. All of these have had a longer or shorter trial at the Victoria Park Hospital. Mercuric Chloride was ill-borne by the patients and had to be discontinued. Helenine and Periodates appeared in no way to affect the course of the disease, and the same remark applies to preparations of tar. As regards the latter, however, it may be said that there was a certain amount of relief to symptoms, especially in those cases in which considerable bronchitis existed in conjunction with the tubercular disease. In simple bronchitis, especially where there is a considerable secretion, the preparations of tar are certainly useful. It may be given in the form of Syrupus Picis Liquidum made according to the "United States Pharmacopœia," or in one of the more recent forms introduced by Messrs. J. Bell and Co., *e.g.*, Liquor Picis Aromaticus, with a dose of a drachm three or four times a day. The objections which seem to be potent with regard to the administration of antiseptics by the mouth are :—First, there is no evidence that the drugs can be absorbed into the blood-stream in a strength to act as a germicide at the seat of the disease in the lung; and secondly, there is no proof that the drugs so taken actually penetrate into the interior of the diseased foci, the objections being similar to those which have been brought against the plan of inhalation or instillation. The fact that when creasote is taken in large doses the breath smells of the drug may, however, be taken as evidence that drugs are absorbed and excreted by the lungs

in gaseous form, and it seems, therefore, if absorbed in sufficient amount, some beneficial effect should be obtained. We next come to the *method of introducing gases into the rectum*, which was introduced by Prof. Bergeon, of Lyons ("Comptes Rendus de l'Academie des Sciences," tom. ciii., No. 2, 1884, and elsewhere). The gases employed have been Sulphuretted Hydrogen and Carbonic Dioxide. The rationale of the method is that the gases so introduced would be eliminated by the lungs, and in their passage through the pulmonary tissue would act antiseptically upon the tubercle bacilli. Thus these two gases were chiefly employed. The treatment was tried by a large number of physicians in France and America, and to a less extent in this country. An enormous amount has been written for and against the method. In this country the result of experience has been altogether against it. It was systematically tried at the Victoria Park Hospital, hiefly by Dr. Heron, but without any good result being obtained. The theory upon which it was based has also been called into question.

This brings us to our third division of the antiseptic modes of treatment, which consists—(3) *In subcutaneous or deeper injections of antiseptics into the body of those affected with pulmonary tuberculosis.* A considerable amount has been done in this direction, numerous trials having been made with different drugs, of which those mostly employed have been Eucalyptus Oil, Iodine, Carbolic acid, Iodoform. Many of these substances have also been injected into the diseased areas of the lung. For this purpose also biniodide of mercury has been used, but with anything but encouraging results. Indeed, the dangers of this latter treatment are very great, as acute suppurative bronchitis, fatal in twenty-four hours, acute pleurisy, and other complications have been recorded as

following the injection. We may say that so far no results sufficiently good to justify the great discomfort, which is certain, and the risk of fatal complications which is possible to result from these injections, have been recorded.

It is as well, however, to mention certain other inoculation experiments apparently more successful. Some time ago Opitz ("Die Behandlung der Lungenphthise mittelst Emulsionen von Peru balsam, Vortrag, gehalten im Verein für Natur. u. Heilkunde" in "Dresden-Münchener Med. Wochenschr.," Nos. 47 and 48, 1889) gave an account of a series of cases of phthisis treated in the Dresden Hospital by means of subcutaneous injections of *Peru Balsam*. The injecting material consisted of Peru balsam 1 part, water 1 part, and gum arabic 2 parts, with the addition of 7 parts saline solution. It was neutralized with sodium bicarbonate and sterilized. Only patients whose sputum was rich in tubercle bacilli were subjected to the treatment. The injection was never painless, but no abscesses formed at the place of inoculation, although for a time there was considerable swelling. The result of the treatment was that three cases of early phthisis were practically cured, and tubercle bacilli altogether disappeared from the sputa; five cases of more advanced phthisis, in which the disease had gone on to the formation of cavities, improved in all ways; but in the other patients (number not stated) there was no marked change. The theory of the action of the balsam, when introduced, suggested by the experimenter, was that the balsam is decomposed within the body, and that the products of its decomposition destroy the tubercle bacilli, or at any rate render their secretion harmless. This theory differs from that of Landerer, who had previously employed a ·05 solution of Peruvian balsam as an intravenous injection

in the treatment of phthisis. The latter thought that the balsam, when introduced in the way described, sets up an inflammation in the neighbourhood, by which the tubercle becomes encapsuled and cicatrizes. If the cases described as cured by Opitz remained free from further tubercular trouble, after a longer period of observation than they had been subjected to when his paper was published, and if the cases were undoubtedly tubercular, of which there can be little question, it would seem that the treatment by the inoculation of Peru balsam has been too little noticed.

Of the substances which Koch found to hinder the growth of tubercle bacilli in cultivations, but which he further discovered to be without influence in preventing the spread of the micro-organisms within the body, the following may be mentioned, viz., *certain ethereal oils, B. napthylamin, paratoluidin, xylidin, certain of the so-called tar staining stuffs, e.g., fuchsin, gentian violet, methyl blue, chinolin yellow, anilin yellow, auramin, mercury in form of vapour, and the compounds of silver and gold ;* of the last the *compounds with cyanogen* were especially conspicuous in stopping the growth of the bacilli, even in a dilution of one to two millions. It must be inferred, although it is not certain from what he says,[1] that some of the substances mentioned were introduced by inoculation.

Very many other substances have been found by other observers to prevent the growth of the tubercle bacillus in cultivations, *e.g., hydrofluoric acid, silicic acid, fluosilicates, mercuric ethyle* (1 in 35,000), *ethyle benzoate* (1 in 3,000), *methyl benzoate* (1 in 12,000), and others to delay or modify it ; but none of them have been found to exercise

[1] "Alle diese Substanzen bleiben aber vollkommen wirkungslos wenn sie an tuberculösen Thieren versucht werden."

the same influence when employed as inoculations into tuberculous animals.

There can be no question that, supposing further experience confirms the previous results, the injection of *Eucalyptol* and other volatile substances, as advocated by Dr. J. Roussel, is promising. The following account, copied from the *Lancet* (No. 3,507, p. 1049), certainly is sufficiently exact :—

"In the month of March, 1888, Dr. Roussel brought before the Society of Practical Medicine eighteen patients suffering from phthisis. In the month of March, 1889, he brought the greater number of the same patients (? 10) before the Society, so that they might be examined by the same medical men who had seen them a year previously. These eighteen had received altogether 4,714 hypodermic injections. One of the eighteen patients, who seemed to have recovered his health, started on a journey, contracted double pneumonia, and died. Drs. Tison, Guerdner, Duchesne, Gaudin, Therener, Boyer, Gronineau, and others examined at the end of the year fifteen or sixteen out of the eighteen patients. They all testified that the places where these numerous hypodermic injections had been administered remained in a perfectly normal condition. There was no inflammation. Dr. Dujardin-Beaumetz presided at this sitting, and a resolution was carried to the effect that the numerous injections of various substances had left no trace whatsoever. On the other hand, the patients were either to all appearance well or very greatly improved in health. In several instances the analysis of the sputa showed that the bacilli of Koch had disappeared altogether."

Our experience of the treatment by injections into the subcutaneous or deeper tissues at the Victoria Park Hospital, has been so far quite withou encouraging results.

Of Koch's Method for the Treatment of Tuberculosis.—The introduction of Koch's method for the treatment of tuberculosis marks an important epoch in the history of the treatment of the disease. The circumstances attending the introduction were so exciting, and the hopes which were raised were so high, that the story of the events in connection with the discovery and use of the remedy will always remain of great interest to the medical profession. As the narration has, however, not only an historical interest, but also a scientific value, it will be as well to devote ourselves for a short space to it.

In his address "On Bacteriological Research," delivered before the International Medical Congress in August, 1890, Koch having given an account of the various chemical substances which he had found even in small traces to hinder the growth of tubercle bacilli when cultivated outside the body, but which were without influence upon their growth inside the body, he continued in the following manner:—"In spite of this failure I have not allowed myself to be discouraged from prosecuting the search for growth-hindering remedies, and I have at last hit upon a substance which has the power of preventing the growth of the tubercle bacilli not only in a test tube, but also in the body of an animal. My researches on this substance, although they have already occupied me for nearly a year, are not yet completed, and I can only say this much about them, that guinea-pigs, which, as is well known, are extraordinarily susceptible to tuberculosis, if exposed to the influence of this substance, cease to react to the inoculation of tuberculous virus, and that in guinea-pigs suffering from general tuberculosis to a high degree the tuberculosis process can be brought completely to a standstill without the body being in any way injuriously

affected." Such a statement by one whose previous discoveries had been so remarkable and so sound naturally attracted much interest, but we find few remarks in the medical papers upon the subject in the interval between the closure of the Congress and the date of Koch's preliminary paper, which was called "A Further Communication on a Remedy for Tuberculosis," which was communicated to the "Deutsche Medicinische Wochenschrift," and published about November 15th. In this communication he described the action of his new remedy, the nature of which was reserved for a further communication, which he had been using upon tubercular diseases of man, having already proved, at any rate to a certain extent, its potency upon animals. The fluid, which was described as of the colour of brown sherry, was to be used diluted and injected subcutaneously, best with a syringe without any piston, but furnished with a small india-rubber ball, for convenience of sterilization with absolute alcohol. The fluid, when injected into healthy individuals in doses of 0·01 ccm., produced slight, if any effect, nor if injected into patients suffering from other than tubercular disease. If, however, any tubercular material existed in the tissues of the injected individual, about four or five hours after the injection marked fever resulted, possibly accompanied with malaise, pains, coughing, a great sense of fatigue, with or without nausea and vomiting. This fever soon received the name of "reaction;" it lasted for a variable number of hours and then left the patient no worse than he was before the injection. With this general reaction there was also, in cases of superficial tuberculosis as in lupus, a manifest local reaction, the lupus spots became red and swollen, and might even become brown and necrotic. After the reaction the swelling subsided in two or three days

and the patches became covered with a crust, which, falling off after a variable time, left them as clean red cicatrices. This local reaction, manifest in the case of lupus, Koch believed to take place in internal tubercle. The action of the remedy, according to Koch, was to produce necrotic changes in the tubercular tissue. It did not kill the tubercle bacilli, nor had it any power upon anything but living tissue; it had no action upon necrotic cheesy masses, necrotic bones, etc. In acting upon tuberculous tissue it might leave living tubercle bacilli in the dead tissue. Koch appeared to think from the first that the remedy would require to be assisted in the case of external tubercle by the knife. It did not appear clear from the original paper how the necrotic patches were to be got rid of in the case of the lungs. The patient by degrees could be treated with larger and larger doses of the remedy, with less and less severity of the reactions. As regards the lung tubercle with which we have to do, Koch claimed that the action of the remedy was to produce at first an increase of cough, which was speedily followed by a decrease and in favourable cases by cessation. The sputum became less and less and changed from purulent to mucous in its nature, and the bacilli in it decreased in number and altered in appearance. In four or five weeks the patients suffering from early phthisis were practically cured, sweating and cough having ceased, and increase of weight having begun. Koch so far committed himself to the opinion that "phthisis in the beginning can be cured with certainty by the remedy." He claimed improvement even in more advanced cases in which cavities were present, and only in those whose lungs contained many large cavities could no improvement be shown objectively, and even their symptoms were ameliorated.

To summarize, Koch claimed for his "lymph" a power of producing such a change in living tuberculous tissue that the tubercular process ceases in consequence of the death of the bacilli-containing tissue. He suggested that the general methods of treatment of phthisis, such as mountain and other forms of climatic treatment, fresh air and special diet, should be combined with his injections. He did not claim that his lymph killed the bacilli or that it possessed any power of conferring immunity upon the person injected.

The excitement produced by Koch's paper was quite unprecedented; not only the medical, but also the lay press combined to arouse and increase the interest in the application of the remedy. Medical men from all parts of Europe and America, with or without patients, and patients with or without doctors flocked to Berlin in crowds; the treatment was demonstrated by the various assistants of Koch to admiring audiences daily, and the fluid itself became so precious that hundreds of pounds were offered for a few centigrammes. The majority of the London hospitals and also a large number of the provincial hospitals sent delegates to Berlin to report upon the method. A considerable number of these delegates, after a longer or a shorter time, returned with small amounts of the remedy; our colleague, Dr. Heron, and Mr. Watson Cheyne were requested by Koch to give public demonstrations of the method of treatment in London, and in the Victoria Park and King's College Hospitals the remedy was first of all made use of in this country. The first demonstrations at the hospitals named attracted much interest, and the course of the disease under the method of injection was attentively followed by large numbers of practitioners from all parts of the country. It may be mentioned that a week after

the publication of Koch's paper it was noted in the papers that 1,500 medical men had arrived at Berlin. Also that one of Koch's assistants had been obliged to start no less than eight temporary consulting rooms in different parts of the city to inject those who demanded the treatment, and that these were open and thronged night and day with rich and poor, young and old, and that the assistant, when he arrived at the different rooms, had to make his way through tightly packed crowds!

From this period the use of the remedy, which was called on the bottles in which it was sent out "Tuberculin," became widespread both in England, the Continent, and America. In the course of a few weeks' trial it became evident that the remedy was one which required much care in the handling, the effects appeared to be very severe, and after a short time some began to inquire whether the results of the treatment were any more favourable than those obtained in ordinary cases of phthisis by treatment in the usual manner.

The remedy up to this time was a so-called "secret remedy," and a considerable amount of blame had been cast by some upon Prof. Koch for having allowed the lymph to be used without proclaiming to the world its composition or method of preparation, and upon those who, without knowing its composition, yet employed the remedy. The truth of the matter appears to have been that Koch's hands had been forced by some member or members of the German Government, who were too anxious that the great discovery should be quickly given out to the world. No blame appears to be attributed to the Professor himself, except it be for having been too compliant to the wishes of the said Government officials. In January, 1891, however, Koch was able to see his way

to giving an account of the nature of the remedy and of its manner of preparation, which was published in the "Deutsche Medicinische Wochenschrift" of January 15th, 1891.

It appeared from this communication that the lymph consisted of a glycerin extract of pure cultivations of tubercle bacilli. The strength of the glycerin used was 50 per cent., the composition of the material, according to Koch, being governed by the solubility of the chemical bodies present in the cultivation, in glycerin. Thus it contained the active principle, certain mineral salts, pigment, and extractives of unknown composition. The glycerin extract was capable of being purified, as the active principle could be precipitated by means of absolute alcohol and permitted of drying, etc., without alteration of its properties; but without any advantage. The nature of the principle contained in the remedy Koch believed to be a body, one of the derivatives of albumin and in close relation to it, but not a toxalbumin, he thought, because it withstood the action of high temperature and was capable of dialysis. The amount of this substance present in the lymph was very small, to be reckoned in fractions of one per cent. In its action upon tuberculous organisms it surpassed that of the strongest drugs known.

Koch, in his second paper, proceeded to consider at greater length the action of the drug and to elaborate his theory. This may be briefly summarized. The poison produced by the bacilli in the body is the same as that produced in artificial cultures, and this exercises a deleterious influence upon the cells—the living elements of the tissues. By its influence the protoplasm undergoes what Weigert had called "coagulation necrosis," and when this occurs the bacilli contained within the necrotic

area are no longer able to develop, and after a time die off. As the bacilli are thus killed by the products of their own action, it follows that the extent of the necrosis is limited by the amount of poison generated. A single bacillus in a cell, for example, would be only able to produce a poisoning, and consequently necrosis of part of the cell, and the remainder would take on that peculiar growth resulting in the giant cell. The action of the injected poison would be the same, viz., to produce a necrosis of the cells in the neighbourhood of tubercular foci, with the result that the bacilli in the necrotic tissues would die off ultimately in larger amounts than in the ordinary process. The tuberculous tissues react to smaller doses of the poison than healthy tissues, because they are already impregnated to a certain extent with the poison produced by their own bacilli. Healthy organisms react to large doses, however, and a disintegration of the cells of the body may be the cause of the fever and other symptoms produced by the injection of more than a minimal dose. The leucocytes of the blood are those which are the most affected.

It so happened that about ten days or a week before Koch published his second paper, namely, upon the 7th January, 1891, Virchow[1] gave an account of a certain

[1] Prof. Virchow drew attention to the dangers which might ensue from the injection of tuberculin, basing his observation upon the examination of about thirty cases in which the injection had been made use of. He had found extreme engorgement of the vessels of the pia mater with tubercular meningitis; acute hyperæmia and swelling in other parts with hæmorrhagic infiltrations and evidence of recent hæmorrhages into cavities. These were the results not of mere congestions but of actual inflammation. The lymphatic glands in some cases were particularly noted as being enlarged and swollen, and leucocytosis was markedly present in them. The swelling in the larynx would naturally have been dangerous from its obstructive

number of autopsies which he had occasion to make upon those who had died after having been subjected to Koch's treatment. The appearances he described were somewhat startling, and his conclusions as to the action of the remedy were to a considerable extent unfavourable.

Prof. Virchow's objection to Koch's remedy fell under two heads, first, the dangers attending the injections, not only of severe fever and inflammations of organs, especially of the lungs, but also of the possible dissemination of the bacilli in a condition not dead but living, and

tendency, but in some case or cases actual phlegmonous ulceration was present. In the lungs there were evidently changes which could be declared to be recent, also severe and sometimes hæmorrhagic pleurisy. The chief appearance in the lungs was caseous pneumonia. Fresh tubercles, too, could be made out, but particularly in the serous membranes, the pericardium as well as the pleura and the peritoneum being implicated. Again, there was sufficient evidence that Koch's idea that the tubercles themselves would of necessity undergo change was not always carried out, since many and recent unaffected tubercles were to be seen. Virchow admitted that the remedy must have a powerful effect upon tubercles, but denied that this effect was by any means universal. Seeing that the tubercles are as it were broken down by the remedy, and that the bacilli are not killed, he suggested that it was by no means unlikely that the effect of the injections was to mobilize the bacilli and distribute them over the body with production of new tubercles in places in which they had not formerly existed.

He also drew attention to the possible effect the remedy might have upon intestinal tubercle, illustrated by the result of a post-mortem examination, in which there were large patches of necrosis which had extended down to the peritoneum, and if the patient had lived a couple of days perforation would almost certainly have occurred. In the lungs, too, he cautioned against the dangers which might ensue from a patient being unable to expectorate the necrosed material, the danger both from retention and from possible aspiration. He had noticed in one case abscesses in the lungs extending from bronchiectases, and also crops of fresh tubercles in the larynx.

so able to set up tubercle throughout the body. The second objection was that the remedy did not in all cases do even what was claimed for it, *i.e.*, it did not produce the effect upon the tubercular tissue that Koch was led to believe would always follow the injection. The criticisms were admittedly so damaging that it was stated by some that then and there would be an end to Koch's new remedy for tuberculosis. This, however, did not at once follow. The injections were used in numberless places for several months afterwards. More and more testimony, however, of the danger attending the use of tuberculin accumulated from all sides. It was even said by some observers that tubercular bacilli could be demonstrated in the blood of those injected, and although this observation was never, we believe, confirmed, a tendency arose to regard the danger attendant upon the use of the remedy as seldom justified by the results.

In this country discussions as to the value of the injections of tuberculin took place at several of the Scientific Societies, notably at the Medical Society, where the discussion was introduced by Dr. Heron, who probably had a larger experience of the use of the remedy than any other physician in England, at the Royal Medical and Chirurgical Society, where an address was given by Mr. Watson Cheyne on the use of the remedy in the treatment of surgical tuberculosis, both in April, 1891, and later on in the summer of the same year at the Annual Meeting of the British Medical Association at Bournemouth. In addition to these discussions there were elaborate reports upon the use of the remedy by the professors and directors of the various clinics and polyclinics in Prussia, which was published as a supplement to the "Klinisches Jahrbuch." The reports were from no less

than forty-three University clinics and "polikliniks," besides twelve others from other hospitals and institutions. Reports were also published from other countries, France, Austria, Russia, Australia, etc.

It must be confessed that these reports, taking them all together, were not very favourable to the treatment, although many and quite impartial observers were inclined to take exception to the general view. This was, we think, particularly marked at the British Medical Association meeting. Several practical physicians appeared to disagree with the more general view that the treatment was of no value. The method has, however, fallen into practical disuse. It is now, we believe, only used for diagnostic purposes, to discover whether or not tuberculosis is present in cattle.

Looking back now for several years upon the rise and fall of this remedy, we may, we think, be allowed to summarize the evidence as follows:—The injections of small quantities of the tuberculin, carried out with care, and spread over considerable periods, were free from danger of producing untoward complications, and if persisted in for many weeks or even months, were followed by improvement in a large proportion of the early cases of pulmonary tuberculosis, and in a smaller proportion of cases at a later stage of tuberculosis, but that improvement seldom or never resulted in the advanced cases, many of which were obviously injured by the treatment.

Secondly, that improvement ensued in a considerable proportion of cases of external tuberculosis, *i.e.*, in lupus, but that actual cure was never seen. When used in such affections the injection method required to be supplemented by the aid of the knife, scoop, or caustics of some

kind. In the majority of cases in which improvement was noticed there was a distinct tendency to relapse, so that the injections even in lupus were considered but little improvement upon the ordinary methods of treatment.

Thirdly, that in the case of tubercular joint affections, a certain amount of improvement was often noticed, but that in such cases the cure was never complete. Mr. Watson Cheyne, in a very careful and elaborate analysis of his cases, believed that but little good could be hoped for in cases of surgical tuberculosis before extirpation with the knife, but suggested that after the ordinary surgical means had been tried tuberculin might be potent enough to destroy any small outlying foci of disease which had escaped the surgical procedures.

No doubt a considerable reaction from the exaggerated expectations from Koch's treatment was the cause of the disfavour into which the remedy fell so soon after its introduction, and, in the second place, a dislike on the part of a great majority of the profession to the use of a highly poisonous material, the virulency of which was likened to snake poison, without a knowledge of its approximate composition. Koch himself was much blamed for letting loose upon the public a remedy so potent for evil, without informing the profession as to the nature of its composition. It came out, however, later on in the autumn of 1891 that Koch himself had somewhat indefinite notions of the exact composition of the poison, and his attempts to procure a purified tuberculin were considered by many as decidedly unsatisfactory. His methods, too, were somewhat called into question. Laborious researches, undertaken by Koch himself,

assisted by the best possible help to be obtained, seemed, however, more likely to be successful than the somewhat hasty and possibly rough methods which were adopted elsewhere in the same direction. Koch used many reagents for the purpose of isolating the active principle of his remedy, but alcohol, nearly absolute, was the material of most assistance to him. His further researches enabled him to procure a principle from tuberculin fifty times as strong as the crude product, but whether this substance had any advantage over the material as first introduced appeared to Koch to be doubtful. The crude material, which, as we have seen above, was made with glycerin, appeared not to alter on keeping, but if diluted it speedily did so. However, in the minds of some there was no certainty that the remedy had even a specific composition, and although the lymph underwent a rough standardization before being sent out of the laboratory, no proof was brought forward that it could not undergo subsequent changes. All bodies proteid or allied to proteid are proverbially unstable.

The so-called reaction, which at first was looked upon as a characteristic of the action of tuberculin, and almost as a test as to whether the remedy was going to be effective or not, later on came to be looked upon as a complication, and efforts were made to prevent the high fever and other symptoms of serious constitutional disturbance by the purification of the tuberculin of the substance which produced them. Dr. William Hunter succeeded in isolating a substance which was in his opinion the cause of the reaction.[1]

[1] *As regards the composition of Tuberculin.*—The composition of tuberculin is complex. It contains, according to Hunter, several bodies of albuminous nature, belonging to the class of albumoses or proteoses, certain salts, extractives of unknown nature, mucin, and

Tuberculocidin.—This substance was prepared by Prof. Klebs from Tuberculin, by precipitating the noxious substances, those, namely, which produce the fever and severe symptoms observed after injections of tuberculin, by means of platinum chloride. The curative agent remains in solution. Klebs found that by injection of this substance he was able to confer partial if not complete immunity to the action of the tubercular bacilli upon guinea pigs.

When tried upon patients affected with tuberculosis, considerable improvement was noticed, and none of the

also of several, certainly two alkaloidal substances. It is possible to isolate the albumoses, and to them the healing action of tuberculin is to be attributed. To the alkaloidal substances the fever is believed to be due. As regards the local inflammatory action, this too is associated with the albumoses and seems also to be unessential to the healing action. It would seem to follow that the material which has a specific action on tubercular tissue is mixed up with other bodies of the same nature, and also with alkaloidal bodies which have a distinctly poisonous action on the body. Koch, in his third paper relative to his method, stated that the active principle was neither a ptomaine nor an alkaloid, but was more nearly allied to the albuminoid class. He asserted that it was difficult to obtain this substance pure, as it was very easily split up. Koch did not appear to recognize that there was more than one albuminous substance present; neither was he so clear as to the ex nature of the albuminous substance or substances present. He observed that it was not an albumose, but gave rather an insufficient reason for coming to this conclusion, namely, that it withstood very high temperatures. It was not a peptone because it was precipitated by a solution of acetate of lead.

Dr. Hunter and Mr. Watson Cheyne reported, at the meeting of the British Medical Association already alluded to, the results of clinical observations with the various substances obtained from tuberculin. We have been unable, however, to find any further recorded observation of the use of the materials, and so must suppose that they have shared the fate of the original substance from which they were derived, namely disuse.

untoward symptoms of tuberculin injections ensued. There was no mobilization of the bacilli, nor yet severe laryngeal symptoms in the case of laryngeal tubercle. The blood pressure did not fall, and although with very large doses it was possible that a certain amount of malaise resulted, yet this was neither persistent nor dangerous. The amount of tuberculocidin in crude tuberculin is only about two and a half per cent. As regards the different substances of which tuberculin consists, Klebs asserts that the injurious or toxic substances are removed by alcohol and filtration, that the albumoses which are also injurious or unnecessary are precipitated by the so-called alkaloidal reagents, leaving behind tuberculocidin, which is supposed by the introducer to be the secretion of the tubercle bacilli, as against the other albumoses which are derived from the mycoprotein of the bacilli themselves.

Dr. Carl Spengler, of Davos, who reported upon the action of this substance at the request of Klebs, asserted that it relieved the dyspnœa of phthisical patients and reduced the hectic fever, whatever else it might do in addition.

We have tried the injection of tuberculocidin in early phthisis at the Victoria Park Hospital, but were unable to note any alteration whatever, either for good or ill, in the course of the disease thereafter. It should be added, however, that the number of cases in which it was used was altogether too small to be a very fair test of the value of the remedy. We believe that the method has not been extensively tried in this country.

Cantharidinate of Potash Injections.—The injection of cantharidinate of potash in doses of one or two up to six decimilligrammes was recommended by Prof. Liebreich as a remedy in tuberculosis. The theory upon

which he based his recommendation was a somewhat peculiar one. When cantharidine is taken internally serum is exuded from the capillaries not only of the kidneys, as shown by albuminuria, but also of the lungs and other organs. The irritability of the capillaries differs in various regions, and the greater the irritability the greater the exudation. A dose of cantharidine too small to produce exudation from healthy capillaries might be supposed to produce such an effect upon diseased vessels. The vessels in the neighbourhood of tubercular deposits are presumably in such a condition of irritability. If this be the case, the exuded serum might act in one of two ways, either by nourishing the cells and bringing them back to their normal condition when in a state of imperfect nutrition, or by the inherent disinfecting action of the serum upon the diseased focus. Assuming this theory to be a correct one Liebreich suggested that it might be easy to administer with the cantharidine some antiseptic substance which, when taken into the blood, does not alone easily pass through the capillary walls, but might with the specific action of the cantharidine be made to pass out from the vessels at the diseased spots and so aid the comparatively weak antiseptic action of the unfortified serum.

Cases treated by the injection of cantharidinate of potash were brought forward at the Berliner Medizinische Gesellschaft at the end of February, 1891, which were said to show "marked and in some cases surprising improvement," by Prof. B. Fraenkel and Dr. Heymann. This method of treatment was tried by several in this country, with no good results. Thus, Dr. Wm. Carter, Liverpool, reported in April, 1891, unfavourably of it, not only that it did no good, but that pain at the seat of the injection (prevented by the application of cocaine)

and gastric pain had not infrequently resulted. A careful investigation into the literature of the subject, and an experimental research into the use of the drug by injection, was undertaken at the latter part of the year, and published in the "Brit. Medical Journal." The evidence in its favour was for a time considerable. The most good was believed to result from its use in laryngeal tubercle. In pulmonary tubercle no good results were recorded. Some authors, however, denied its efficiency even in laryngeal tubercle, and reports as to the complications set up by the injections were not only, as in Dr. Carter's cases, pain at the seat of puncture and albuminuria, but also vomiting, abdominal pain, and diarrhœa.

The plan of treatment was not much tried in this country, but Drs. S. Fenwick and Welsford employed it in 16 cases, and published their results, which were unfavourable, towards the end of 1891. Their conclusions were the following:—" (1) That cantharidinate of potash is absolutely useless in producing any obvious beneficial effect in pulmonary tuberculosis. (2) That in doses exceeding 0·2mg. it is apt to produce albuminuria, with pains in the loins, strangury, and even hæmaturia. (3) It should in no case be used without most careful supervision, and is, therefore, ill adapted for out-patient practice." . . . "As far as our observations go we have detected no improvement in the condition of the laryngeal affection."

It thus appears that the injection of cantharidinate of potash has been attended with no apparent improvement of the condition of tuberculous patients. Indeed it would hardly be necessary to mention the method were it not for the high reputation of Prof. Liebreich, who introduced it.

njection of the Serum of the Blood of Different Animals.—The treatment of specific diseases by the injection of the serum from the blood of animals which are either naturally immune to it or have been rendered artificially immune, has within the last few years received considerable attention. The extraordinary fact which has been demonstrated without possibility of error that while one animal is highly susceptible to a certain disease, another not far removed from it in the animal scale may be quite insusceptible, is the basis of this form of treatment.

Thus the mouse is very susceptible to anthrax, whereas the rat is not. We may even go further and say that one kind of mouse is susceptible, *e.g.*, the domestic mouse, while the field mouse is not. And in the degree of susceptibility of animals to anthrax a list might be made with the mouse at the top of it, next to which in order come guinea pigs, rabbits, sheep, and horned cattle, next the animals such as man, and below man in the degree of susceptibility come the carnivora, and among these cats are more susceptible than dogs. It is unnecessary to go further into the question of the absolute immunity of some animals to anthrax than to say this, that rats are remarkably insusceptible to the poison, and that birds, frogs, and lizards are either insusceptible or are only susceptible under abnormal conditions.

Using this fact, which has been worked out by many bacteriologists, Hankin employed the serum of the blood of rats to protect mice from the action of the anthrax bacillus. Thus if a mouse has been inoculated with anthrax in lethal doses, and this mouse is then inoculated with a small amount of rat's blood serum, the animal is able to resist the action of the microbe, and lives just as though it were a rat. Here we have examples first of all

of a natural immunity to anthrax on the part of the rat, and of artificial immunity to the disease produced by the injection of rat's blood serum on the part of the mouse. We may even go further than this, and say that the substance that the serum contains, which procures an immunity for the susceptible animal, has actually been isolated from the rat's spleen. A great amount of real knowledge exists as to the poison of anthrax and as to all the circumstances attending the growth of the anthrax bacillus, since anthrax is the disease which, beyond all others, is a striking example of the causation of diseases by bacteria, and as such has been specially worked at for many years.

We know much less as to the exact conditions of the life and growth of the tubercle bacillus within the body, although our knowledge also of tuberculosis is increasing year by year. Attempts, then, to obtain the same result as has been obtained in anthrax by producing artificial immunity in animals and man to the tubercle bacillus, are only now in an early experimental stage. Several efforts, however, in this direction have been made. The serum from the blood of goats, which were said to be immune to tubercle, has been used on the one hand by Lepine and Bernheim, and the serum of dogs' blood has been employed by Richet on the other, as injections to stay the progress of tubercle in the human subject. The dog is said to be *almost* immune to tubercle. The use of dogs' serum has, therefore, been used to a considerable extent for the purpose of treating tuberculous patients at the Paris Hotel Dieu and in other places in France. A report upon the method was given by Dr. Beretta, of Paris, at the meeting of the British Medical Association in 1891. The method adopted was the following:—Injections of one or more cubic centimetres were made every two days into the subcutaneous tissue of the limbs

or trunk, the strictest antiseptic precautions being of course observed, great care being also taken that no dog not in a physiologically sound condition should be the source of the serum employed.

The result of the treatment, according to the same authority, was the following :—In about one-third of the cases in which it was tried (no numbers being given, but only "numerous cases, both medical and surgical") no result was apparent. In the other two-thirds a real improvement of symptoms, more or less marked, was observed. The injections did not seem to have a curative, but a tonic effect.

It may be added that the serum from the blood of steers and sheep appears to produce the same effect as that of the dog.

Dr. MacFadyean, of Edinburgh, in a letter commenting upon this method of treatment, drew attention to the fact that dogs are not immune to tuberculosis. He says: "The canine species possesses no immunity from tuberculosis, and both dogs and cats are frequently the subjects of the disease." He adds: "Jensen established the existence of the danger in no fewer than fifteen dogs that were examined post-mortem at the Copenhagen Veterinary College between December, 1889, and December, 1890." Such evidence as this appears to disprove altogether the theory upon which the treatment of human tuberculosis by the injection of dogs' serum is based.

Another attempt in much the same direction to treat human tuberculosis by means of serum from the blood of another animal said to be either immune or refractory to tuberculosis has been more recently before the public, viz., that of Dr. Viquerat, of Moudon, Canton de Vaud, Switzerland. This method of treatment has been most

carefully examined and reported upon by Dr. Arthur Gamgee, whose very lucid and able report is contained in the "Lancet" for October 6th, 1894.

This new method of treatment consists in the injecting of the serum of asses' blood into the tuberculous patient in doses of 12 ccm. every third day. The introducer of this method has found that among animals which are *almost* immune naturally to the influence of the tubercle bacillus are the ass and the mule, and apparently at first was satisfied with their natural immunity as enough to confer immunity upon other animals when the serum from their blood was employed as an injection. As, however, these animals are not absolutely immune to the influence of the micro-organism, he has deemed it expedient to supplement their natural immunity by artificial means, adopting the plan which has been apparently so successfully carried out by Behring, Kitasato, and Roux in diphtheria. Thus the animals from which the serum is to be obtained are injected with active bouillon cultures of the tubercle bacillus, 30 ccm. subcutaneously, and at the same time 15 ccm. into the jugular vein. This injection, Viquerat asserts, sets up a tuberculosis in the animal without any marked symptoms, no rise of temperature even being observed. The tubercular deposits are, so the author states, entirely re-absorbed (!), and at the end of 45 days the blood is thoroughly immune and suitable for supplying the protective serum. The animal after this date is bled, and the blood is allowed to clot over ice. When the serum separates it is mixed with 0·5 to 0·75 per cent. of carbolic acid, and kept in stoppered bottles until wanted. This serum, Viquerat further states, when injected every second day into guinea pigs which have been rendered tuberculous by the injection of active cultures of the bacillus fifteen days previously, instead of

dying in the ordinary way in the course of a couple of weeks, improve, their swollen glands subsiding, and in time regain perfect health.

The cases which have been treated by this protective serum are also in a great majority of cases said to have improved. The number of these cases is too small, and the exact conditions before treatment too indefinite, for anyone to feel at all certain that the method so far has been a success.

It should be noted, however, that these methods of inoculation are of great interest from a therapeutic point of view, and that the tendency at the present day is certainly to associate cure of a distinct bacterial disease with the products of the bacteria themselves, with their secretions, or with some protective secretion of the living cells—leucocytes, or tissue-cells (?)—excited by the presence of the poison of the disease in an attenuated form.[1]

[1] The extraordinary advance which has taken place in the knowledge of the bacterial processes in disease since the introduction of Koch's tuberculin is sufficient to mark that event as one of the greatest importance. Koch's attempt was the first in the direction of using the bacterial products in the cure of the lesions produced by bacteria in the system, although it is true that somewhat similar attempts were being made by others, and especially by his pupils, Behring and Kitasato, in the same direction about the same time. The active principle or principles of tuberculin were found to be albumoses, and these were derived either from the products of the life of the bacteria upon the nutrient medium whether within the body or outside of it, or from the breaking down of the bacteria themselves. The exact action of the albumoses when introduced into the body was not fully understood. Koch's explanation was not generally accepted. The more recent attempts to treat tetanus and diphtheria, however, differ from Koch's method in this way:—Koch did not use any means of attenuating the poison contained in his tuberculin, whereas in these plans of treatment attenuation or alteration is attempted in two ways. Thus, in the most modern development of the so-called antitoxic serum treatment the first thing that is done is to procure pure cultivations of the bacteria of

"Heilanstalt" and Open-air Treatment.—Although it is easy to point out the ideal treatment of phthisis it is by no means easy to induce patients to carry it out, except for short intervals of time. Recognizing this difficulty Dr. Brehmer started the proposition some years ago that for the effective treatment of their disease patients must be content to resign their liberty into the

the disease, tetanus or diphtheria, in suitable nutrient material, then to remove all the bacteria and spores from the liquid culture media by filtration through unglazed porcelain. The filtrate contains the pure poison which produces the disease; the activity of the virus then may (or may not) be attenuated by the addition of certain chemicals. Iodine has been used by Roux, and the German bacteriologists employ either trichloride of iodine or double chloride of gold and sodium, and a weakened vaccinating liquid is obtained. This weakened virus is then introduced into a largish animal in perfectly good health, either a sheep or a horse, in small doses. The symptoms induced by this inoculation are very slight, only a certain amount of fever. These inoculations are repeated until no symptoms of constitutional disturbance are produced by the operation. Next the strength of the inoculated virus is increased, and when the animal no longer reacts to such doses of the poison it is injected with virulent and undiluted poison, sufficient to kill at once an unprepared animal. When this does not produce in the animal the signs and symptoms of diphtheria, the animal is considered to be immune, and the serum derived from its blood is used to cure the disease in other animals. When all the details of the method have been rigidly attended to it is found that the serum has remarkably curative qualities. For example, guinea pigs which quickly die from diphtheria, in from thirty-six hours to two days after inoculation of the diphtheria poison, if treated by an injection of the serum from an animal rendered immune from the disease a few minutes after the inoculation (1-5000th of the body weight is sufficient), do not develop the disease at all. If the curative injection is postponed the amount of the anti-toxin serum must be increased considerably, but the good effect is generally the same. Very much the same remarks apply to tetanus as to diphtheria, and also to several other affections which it is not necessary to mention here. The effect of the anti-toxin serum when employed upon human beings affected with diphtheria has been

hands of the doctor and submit to such rules of life as may be prescribed. In order that complete control should be exercised by the doctor it was obviously necessary that the patients should remain under constant supervision, and this was only possible in private or public institutions entirely given up to the purpose. Such an institution Dr. Brehmer himself set up at Goebersdorf, in Silesia, and the success which he has met with has given rise to

shown to be beneficial, and the method of treatment is now being very much employed. It cannot be said that the exact action of this remedy is yet understood. It has, however, been suggested that immunity is procured in the inoculated animals by stimulating their living cells, whether leucocytes, wandering or fixed cells, to secrete an albumose which has the power of counteracting or paralyzing the toxin of the disease which is associated with the bacteria which are the exciting cause of it, such an albumose being called an "antitoxin." Of the exact nature of the toxins and antitoxins we are not yet fully acquainted. They are probably of the ferment class.

It seems unlikely that the attenuated virus which after a time renders animals immune to the disease, produced by the virus in an unattenuated form, acts by increasing the power of the tissues to produce more leucocytes, and to render these cells more capable of absorbing and rendering inert the bacteria of the disease.

The attempts to treat tuberculosis upon the same lines as have been found successful in diphtheria and other diseases have not been hitherto attended with results of undeniable benefit to the diseased patient. The attempts, however, of Richat, Hericourt, and more latterly of Viquerat, appear to be in the right direction. What is wanted in order to repeat the successful process of Behring and Kitasato appears to be first of all the discovery of an animal immune to tuberculous poison, or failing that one that may be rendered gradually immune to the disease by the introduction of the attenuated tubercular virus. At present, however, it does not appear that any tubercular poison, apart from the bacilli, has been isolated which has the property of producing the tubercular processes when introduced into the animal body. Tuberculin, apart from the tubercle bacilli, induces the constitutional effect, perhaps, as indicated by fever and malaise, but it does not produce the local lesions.

similar enterprises in different parts of the Continent. The main object of all such institutions is to do for the consumptive patient, during the curable stages of his disease, that which he has not the means and, perhaps, not the strength of will to do for himself. The rules are of necessity somewhat strict, and many minor matters are insisted upon, which appear trivial or vexatious to the patient who does not feel ill, but which are nevertheless essential in an establishment where large numbers of patients are being treated at the same time. There can be no doubt that the system is the best that has ever been attempted, and a very large proportion of success is obtained, especially in the cases of patients who have persevered with it for long periods of two to three years consecutively.

Two great objections to its adoption in England are the fickleness of the English climate, which drives all well-to-do consumptives out of the country during the cold months, and the expense of providing the necessary equipment for the treatment of poor patients so long as the Chest Hospitals are dependent upon charity for their annual income. Perhaps the most important feature of all the establishments for the day-to-day treatment of consumption is the provision for the free enjoyment of sunshine and open air. To keep the incipient consumptive constantly in the open air, and at the same time to guard him against the risks of cold and damp, requires not only careful supervision, but specially contrived appliances in the way of tents, summer-houses, glass promenades, and the like, all of which must be fitted with the necessary means of excluding damp and draughts, whether coming from the floor, the walls, or the ceiling. At some of the South Coast health resorts in England a plan has been started, which might be copied with

advantage in every town or hospital where consumptive patients are habitually treated, of providing shelters constructed of wood and glass in the form shown in the ground plan. Such shelters can be made of any size, and can be placed in such positions as the prevalent winds of the locality may suggest. In some places they have been made of a semi-circular form and supported upon a pivot, but this plan while adding to their usefulness must of necessity add also to their cost. These shelters, if used intelligently and under supervision of medical authority, will often enable the consumptive patient to spend the greater part of the day in sunlight in the open air even when the winds are high and cold. Their danger lies in their use when the temperature is too low, and hence arises the necessity for advice before spending much time in them. A careful watch should be kept upon the range of the thermometer, both inside and outside of the shelter, and the question carefully considered before the patient is allowed to make use of it.

For private homes and institutions surrounded with good grounds, the use of large tents with raised wooden floors is to be commended, the walls being well protected with curtains of sufficiently thick material, and capable of being open or shut as the position of the sun or the wind at any time of the day may render advisable. In such tents even patients who are too weak to walk about or sit in ordinary chairs can be placed on couches or long "deck chairs," and thus enjoy the fresh air without risk.

The absolute uncertainty of the climatic conditions in this country has always deterred the adoption of any permanent means of using fresh air as a therapeutic agent, but much could be done to render the lives of the

poorer classes of consumptive patients both happier and longer if more advantage were taken by these means of the fine weather which prevails during the spring and summer months at such irregular intervals.[1]

[1] In addition to the Institutions for the Open-Air Treatment of Phthisis founded by Dr. Brehmer at Goebersdorf and by Dr. Dettweiler at Falkenstein in the Taunus near Frankfurt, a similar sanatorium has been established upon the same lines at Nordach in the Black Forest (nearest station, Zell, Schwarzwaldbahn), in which the same rigid rules in the treatment of the patients are enforced as in the original institutions. The following notes have been taken from the careful description furnished us by Dr. Rowland Thurnam, who has undergone the treatment himself at Nordach with great benefit. As regards the situation and climate of the locality, he says:—"The climate is very similar to our own, variable and with frequent spells of rain—in fact to many who are familiar with the spot, the English Lake district is inevitably suggested. There is in summer a large proportion of sunshine, but the spring and autumn are usually wet." He goes on to say, "The treatment as I saw it carried out in my own person might be thus summed up: Rest, Extraordinary Overfeeding, and a Life in the Open Air."

The sanatorium is built at the end of a remote valley in the Black Forest, with the view of obtaining mental quietude. The nearest railway is ten miles away, and the nearest town of any size lies fifteen miles over the hills. The valley is small and densely surrounded with enormous pine trees, and there are innumerable water-courses descending the hillsides in all directions, so that the climate may be described as damp. The situation was deliberately chosen on account of its freedom from dust, rather than for the presence of pine trees; in the height of summer it is very rare to see any dust clouds blown along the roads. The absence of coughing so obtained is an obvious and important advantage, and the short, constant cough occurring in a dry high atmosphere is relieved in the somewhat damp, dust-free air, and in my own case was conducive to sleep at nights and absence of pains in the chest by day. The sanatorium lies about 1,300 feet above the sea level and is built on the slope of a hill facing south-west, protected from the north by the dense pine woods.

The houses are built of wood, or are of stone and wood-lined in all the rooms, with polished wood floors. No wall papers or carpets are

The Use of Special Drugs in the Treatment of Phthisis.—Of all the drugs which have been employed in the treatment of tubercular affections *Cod-liver oil*

allowed, being regarded as possible collectors of dirt, dust, and bacilli; so that the floors are sponged over every morning, and after the departure or death of a patient the walls are washed and revarnished. The rooms are heated by hot-water pipes and lighted by the electric light. There is no attempt made to provide more than ordinary comfort. There is an air of extreme simplicity in the whole institution, which is peculiarly restful and soothing. I mention this only because it is a deliberately studied effect, carefully worked out by the medical man in charge of the sanatorium.

The window space in each bedroom is very large, practically half one side of the room, and the windows are never shut. The dining-room, which is a minute's walk from the sanatorium, is enclosed by a roof and the end walls only; the long sides are open to the weather all the summer, and at other times of the year are only partially glazed in.

So it is not difficult to see that everywhere and at every moment a patient is breathing fresh air, uncontaminated by any large town and the respired gases of a fellow patient. This regime is a little trying at first, and often is met with opposition from the friends or from the patient himself. Relations and their visits are discouraged, and most patients are sufficiently impressed with the system not to offer much objection.

At first one feels cold, and, if the weather is wet, extremely uncomfortable; any number of rugs and wraps are allowed but the windows must not be closed. The whole life of the patient is guided by his temperature chart, which he is allowed to keep himself. I may add that all patients take their own temperatures in the rectum. This is done four times a day, at 7 a.m., at 12, at 6, and at bed-time; a temperature of 36·4° C. is a good morning measurement, if there is n fever, and, after mild exercise in the middle of the day, 37·8° C.; if it rises above 38° C. patients must remain resting on their couches until seen by the doctor. At first the treatment is confined to almost complete rest on a wicker couch in the open air all day and removal to bed at six. If the weather is bad—cold and wet—the same goes on, but extra warm clothing is supplied. And all night, even in the cold frost, the windows are open.

stands first. It has been in use for many years, and holds a distinguished place among those remedies the value of which has been proved.

All this while special dieting is prescribed. Though no exercise is taken, the diet is roughly as follows (the maximum is not insisted on for the first few days):

Breakfast.—Half litre of milk, coffee and rolls, eggs and meat as the patient likes. This is the only meal at which one can suit one's inclinations.

Dinner at 1.15.—Half litre of milk. First course about half-pound of beef or fish; second course, about half-pound of veal, mutton, or poultry; as much vegetables as can be crowded into the two platefuls; half-pound bread; half-pound pudding, rice, batter, custard, or ice cream.

Supper at 7.—Same in quantity as dinner, without pudding, and the courses are varied as much as possible.

These two meals have to be taken under the eye of the doctor, and no servant is allowed to remove a plate until quite empty. Alcohol is allowed (as beer or wine), but it is preferred to use it as a reserve food in case of exhaustion.

The results of all this feeding are various. The temperature seems absolutely unaffected. The digestion seems to rebel much less than would be supposed. Patients occasionally vomit in the middle of a meal. They are made *to come back to the table and begin the meal all over again.*

Now I may point out the most striking results of the over-feeding. The patient's weight goes up by two, three, or four pounds per week. It is no unusual thing to find a patient gain five pounds the first week, and after one month two every week.

All efforts are made to increase weight and make the patient as fat as possible. They are weighed once a week.

Temperature and weight being satisfactory, the exercise is begun very much on the plan of v. Oertel's heart-treatment. In cases where the temperature is not running high the walking is allowed from the beginning. The hillsides are cut out in a series of innumerable foot-paths, all having a gentle incline. At the morning visit, while the patient is yet in bed, he is told how far he may walk, which is generally for the first week not more than 400 or 500 yards. Two hours is the time for accomplishing that journey, and about an hour for the return,

The exact action of the remedy is not completely understood. We are still more or less in doubt as to

the pace being absolutely as slow as possible. One foot is slowly swung in front of the other, so that the least possible strain is thrown on heart and lungs. The benefit felt by the patient is that dyspnœa decreases, deeper breaths can be taken, and palpitation disappears. This arrives mostly by the direct improvement in the heart and circulation, also by the careful lung-gymnastic that such slow walking causes. Each morning, in spite of the weather, this prescribed walk is taken, for by this time the patient is no longer timid with regard to getting wet. In fact, as a rule the benefit as shown in increased freedom of breathing is so marked that no patient is anxious to remain indoors, or to forego the slow, fatigueless exercise. Any accompanying heart disease is certainly benefited by this treatment. One important point I have not yet mentioned, that is, the expectoration and the disposal of it. Each patient is very particularly instructed never to swallow it, and on pain of not being allowed to remain at the sanatorium he is warned never to spit anywhere except into one of the receptacles provided for him. These are two. By the bedside is a spitting-pot bearing the number of his bedroom, and in his pocket he carries a stout glass pocket spitting cup, invented by Dettweiler, of Falkenstein, which is emptied for him by the servant, and washed out with liquor potassæ. All sputum is emptied into the drains. It is found to be almost always useless to apply any antiseptic solution to it.

To recapitulate. Mental and bodily rest (tempered with an amount of regulated exercise), over-feeding of a fearless and heroic description, and perpetual fresh air—these are the means taken to combat the disease. The increased ease of respiration, the gain in the weight, and the measurement of the thermometer are the indications of improvement taking place, the measurements of the latter being the important guide in regulating the amount of exercise. The quantity of fresh air is always absolute, and the feeding in large quantity is continued to the end. For the last few months milk is taken off from the diet. And that the desired end is approaching is shown both by the above-mentioned improvements and by the disappearance of bacilli. Careful monthly examinations are made by the usual methods, and the cure is kept up until 10 or 15 preparations have shown no bacilli, and then, as a final proof, a rabbit is inoculated from the patient's expectoration, and three or four weeks are allowed to elapse to see if the animal will develop tubercular enlargement of glands and die.

whether cod-liver oil is to be considered a drug with a specific action upon the tissues, or merely as a food of high nutritive value. This doubt has always been present in connection with its use ever since its first introduction into this country as a remedy in phthisis, by Dr. Hughes Bennett (of Edinburgh), fifty years ago. That the employment of this oil in wasting disease, especially in consumption, is in the majority of cases attended with beneficial results, shown in the gradual increase in weight and other signs of a more healthy nutrition, cannot be denied. Whether this improvement is to be attributed to the oil itself or to some substance contained in it has always been a matter of disagreement. The nauseating smell and taste of the oil, as originally introduced into the arena of pharmacology, has given rise to many attempts to substitute for it something less objectionable, and these attempts have been chiefly in two directions. On the one hand those who look upon the oil as merely a food have suggested oils of other kinds. In the first place other fish oils, then other animal fats, as for example the fats of milk given in fresh cream, bacon fat, and so on; then the vegetable oil from the olive. On the other hand, those who hold to the theory that the oil contains some active principle, which resides in the cod's liver and which goes into solution in the oil, have used considerable ingenuity in isolating such active principles and in exhibiting in the place of the oil itself extracts of it free from all oily character. All of these attempts appear to us to have been more or less unsuccessful, and although, no doubt, fats such as those we have named possess some nutritive value in phthisis, no one of them can be looked upon as an efficient substitute for cod-liver oil. With reference to the so-called extracts of the oil, more modern researches throw considerable doubt upon the supposition that cod-liver oil contains, if derived from fresh livers,

any of the many active principles which have been said to reside in it.[1]

[1] Many such extracts have been introduced to the notice of the medical profession as substitutes for cod-liver oil. Of their composition but little is known, but in all probability they consisted to a great extent of the adventitious chemical bodies produced by decomposition in the livers of the fish. More recently there has been brought forward a series of essential principles, obtained by successive distillation of cod-liver oil, and experiments have been quoted to support the thesis that they are of use in the treatment of tuberculosis. What relation these substances bear to cod-liver oil we are unable to say, but it is obvious that much more experience of their action is required before we can receive them into favour in the treatment of phthisis. The bodies are said to be stimulant and diuretic in their action, and are administered in wine. The substances in question are the following:—Butylamine, amylamine, an active base, hexylamine, dihydrotoluidine, a colourless oil, aselline, an amorphous, odourless material, and morrhuine, a thick, oily fluid, from which is deposited morrhuic acid. Cod-liver oil is said by M. Bouillot to act "by the morrhuic acid it contains, as well as by its bases, several of which—butylamine, amylamine, and especially morrhuine—excite the nervous system, accelerate denutrition (? katabolism), as indicated in the considerable increase of urine and sweat excreted, and co-relatively augment the appetite."

A preparation which has been a good deal pushed as a substitute for cod-liver oil, particularly in the United States, we mention chiefly for the sake of pointing out that it has no claim to be considered in any way in the same category—we mean the so-called "emulsion of rock oil." It consists of hydrocarbon bodies, which are, of course, not oils properly so-called. There are, we believe, several other preparations of like nature in the market.

As regards *glycerin* as a substitute for cod-liver oil, we have experimental evidence that this substance has a distinct and appreciable effect upon tissue metabolism, and particularly upon that of the liver. Under these circumstances it may be that glycerin has a function of its own in the treatment of consumption, but it can hardly be considered to be a substitute for cod-liver oil. The effect of glycerin upon metabolism, if we may believe the experiment of Luchsinger (Pflüger's "Archiv.," viii., 1874, 289, and xviii., 1878, 472), is a conservative one, and chiefly influences the formation of glycogen by the liver. Glycerin is a material evidently easy of absorption, and its administration in consumption may be looked upon with no disfavour.

It is, then, obvious that if we require the effect of cod-liver oil we must give cod-liver oil itself, and not its substitutes. It may be laid down as a rule that cod-liver oil should be given in the treatment of consumption if patients can be induced to take it. There are, however, three chief objections to its employment; first, its oiliness; secondly, its nauseating taste and smell; and thirdly, its after-effect of producing nausea, actual vomiting, or possibly fishy and disagreeable eructations for hours after it has been swallowed. These objections may be considered seriatim: first, as regards its oiliness; this, of course, cannot be overcome, unless the oil has undergone emulsion, the advisability of which we shall consider directly. We may sometimes, however, to a certain extent obviate this objection by giving an oil of a specially limpid character; such limpidity appears to us to exist in one or more of the oils to be obtained in the trade. A limpid oil of much the same specific gravity as paraffin oil will often be taken by a patient who finds other kinds to be intolerable. Secondly, as to the nauseating smell and taste. It appears now that no patient need be offended in this respect. These properties reside chiefly in the brown oils which used to be administered, and appear to be due to definite defects of preparation and from using the livers of the fish in a state of putridity. Nearly all the oil which one sees at the present time has but little smell and only a moderately fishy taste. There should be no hesitation then in telling a patient that he may expect quite as much benefit, and indeed probably more benefit, from taking the light, clear, and slightly smelling and tasting oil, than he would obtain from the dark, thick, and strong smelling oil. Then as to the third objection, its nauseating after-effects. A part of these may be

attributed to the fact that oils are sometimes adulterated and mixed with other fish oils, some of which appear to have this objectionable quality to a marked degree, and so this objection may be in part diminished by giving the very best and purest oil obtainable; it cannot, however, be altogether obviated as long as even the best method of preparation hitherto employed for the extraction of the oil from the livers continues in use. It appears from the researches of Heyerdahl [1] that the nauseating after-effects are in proportion to the rancidity of the oil—when this is slight the disagreeable effects are also slight; that the rancidity does not depend upon the free fatty acids, but upon the oxidation of these acids, the formation of hydroxylated acids. A method has, however, been suggested, and indeed employed, by means of which such oxidation is prevented; it consists in performing the whole process of the extraction of the oil from the fish livers in the absence of air, an atmosphere of carbon dioxide gas being substituted. The conclusions which are to be drawn from the researches of Heyerdahl, if these researches stand the test of further investigation, are that the value of cod-liver oil depends upon the glycerides of the peculiar fatty acids [2] it contains, and that the principal point in the preparation should be to preserve such bodies without change.

[1] The reader to whom the subject of the composition and methods of manufacture of cod-liver oil is of interest cannot do better than read the interesting account by Dr. F. P. Moeller, recently published. His book also contains a *résumé* of the researches into the composition of the oil by P. M. Heyerdahl, to which reference is made in the text.

[2] These acids are not the ordinary oleic, stearic, and palmitic usually to be derived from ordinary fats, but those corresponding to bodies called "therapin" (20 per cent.) and "jecolein" (20 per cent.), which are glycerides of such unsaturated fatty acids. The remainder of the oil contains 4 per cent. of palmitin and glycerides of probably new unsaturated acids, not yet isolated.

It will be seen that by careful attention to the selection of the cod-liver oil prescribed much may be done to remove the objectionable features of the remedy, but there yet remain some other details as to its administration, which are of considerable practical importance. First of all the question of the *dose* to be given, and the *frequency* of its repetition. In both these respects the practice of physicians has undergone a marked change. Formerly the oil was given in doses of one or two ounces or even more, repeated three or four times in the day, whereas at present no one thinks of giving as a general rule more than two drachms twice a day. It has been found by experience that more than this amount is not digested, and that when excessive doses are given much of the oil is eliminated by the bowel.[1]

[1] With reference to the quantity of oil given in a dose, the tendency to diminished amounts is seen from the accompanying statistics, kindly compiled by Mr. Wm. Harvey, Chief Dispenser, from the drug books at the Victoria Park Hospital:—

"In the period covered by the eleven years 1860 to 1870, both inclusive, we disposed of 9,186 gallons of cod-liver oil to an attendance of 128,502 cases.

"In the period 1871 to 1880 inclusive, 6,100 gallons to 140,183 cases.

"In the third period, 1881 to 1890, 5,000 gallons to 152,511 cases, and in the three years of the present decade, viz., 1891-92 and 93, 1,600 gallons to 45,400 cases.

"It therefore amounts to this: That in the first period, 1 gallon to 14 cases; second period, 1 gallon to 23·5 cases; the third, 1 gallon to 30 cases; and the fourth, 1 gallon to 28·5 cases. As will be perceived, the decrease in the consumption of oil has been very marked. Of late, however, one or two of our new physicians have given rather larger doses than formerly. I find that in the year 1871 we still used the brown oil in ordinary cases. Then commenced a time when a paler or light brown oil was introduced, and then gradually each year it became less coloured, until in 1880 or thereabouts we had the straw-coloured article. The cost varied with the state of the market. The brown oil

Next as to the *time of administration.* This should be shortly after a meal; about a quarter of an hour after breakfast and again after the last meal before going to bed will generally be found to answer best.

Should the oil be given alone or mixed with other substances?—Many patients after a little practice are able to take off the oil without requiring even a vehicle for the purpose. When this is the case so much the better. As a rule, however, some kind of a vehicle is required. Those which are generally found of most use are the following:—Ginger wine, orange wine, lemon juice, bitter ale, or peppermint water. Some use milk.

A very important question arises as to whether, when patients cannot take cod-liver oil "neat," it is a good thing to exhibit the oil in a condition of emulsion. The public have long ago answered this question with an unqualified affirmative, and freely buy the different emulsions introduced by the various druggist firms. Such preparations have been made to contain a variety of other drugs, with what in our opinion is doubtful advantage. We ourselves seldom prescribe emulsions[1] of oil, and have but little faith in them. In cases in which, however, for some reason or other, perhaps for its moral

cost about 4s. 6d. per gallon, the pale 7s. 6d., sometimes more. Our oil bill has been equal to £260 to £280 in a year. Now it seldom amounts to more than £100 and does not often reach that figure, but it should be recollected that the cost is nowadays considerably less per gallon."

[1] It would be out of place in this book to give any detailed account of the various methods of procuring emulsions of cod-liver oil, especially as from the authors' point of view they are unnecessary, but in case a formula is required, the following (unofficial formulary, Br. Pharmaceutical Conference, 1891) gives an emulsion a little difficult to make, but which will obviate the necessity of having recourse to the various proprietary articles so much advertised, and which,

effect, we deem it advisable to prescribe oil in combination, we have been in the habit of combining it with malt extract in the proportion of two parts of the extract to one of the oil.

Next to cod-liver oil, the most favourite remedy used in consumption is *Malt Extract.* It contains the ferment diastase which has the property of converting starch into sugar, as well as a considerable proportion of maltose or malt sugar.

We have no particular regard for the use of malt extract *per se* in phthisis, except possibly as an aid to

unfortunately, so many of the profession prescribe, really without a knowledge of their composition :—

℞ Olei Morrhuæ, ℥viii.
Ovi vitelli, 2.
Pulvis Tragacanth., gr. xiv.
Elixir Saccharini, ʒi.
Tr. Benzoini, ʒi.
Spirit Chloroformi, ℥ss.
Olei Amygdalæ Amaræ, ♏viii.
Aq. Destil at ad ℥xvi.

Measure five ounces of water, place the tragacanth in a dry mortar and triturate with a little of the oil; then add the egg yolks and stir briskly, adding water as the mixture thickens. When of a suitable consistency, add the remainder of the oil and water alternately with constant stirring, avoiding frothing. Transfer to a pint bottle and add the other ingredients previously mixed; shake well and add water, if necessary, to produce sixteen ounces. Of this mixture two to eight drachms may be taken as a dose twice a day.

Another and simpler formula is the following:—

℞ Olei Morrhuæ, ʒii.
Mucilaginis acaciæ, ʒii.
Syrupi, ʒiii.
Tinct. Aurantii recentis, ʒi.
Aquam Carui ad ℥i.

To be taken two or three times a day.

digestion. As a vehicle for the administration of cod-liver oil, a malt extract is certainly useful, but it is difficult to understand the almost mysterious veneration which some physicians, as well as the laity, have for it.

There is such a great demand for malt extracts that large numbers are being from time to time introduced; moreover, it has become the custom for manufacturing druggists to mix up various medicaments with their extracts, and of these substances the one most commonly employed is some Hypophosphite, generally of Calcium. This method of administering drugs is certainly a good one, as the sweetness of the malt sugar disguises the taste well. With reference to the use of *Hypophosphite of Calcium* in phthisis, our colleague, Dr. Thorowgood, some years ago collected considerable evidence of its value, and we have made use of it to a large extent. It is, of course, very difficult to gauge the action of any remedy in the disease we are speaking about, but from our own observations we are inclined to place a certain amount of confidence in it. That such a drug might have a decided influence is not by any means inexplicable, as if it be absorbed the calcium and phosphorus which it contains might be supposed to alter to a certain degree the tissue metabolism, which is evidently so faulty in the disease. The drug may be given thus:—R. Calcii Hypophosphitis, gr. v.; Liquoris Calcis Saccharati, ♏x.; Glycerini, ♏xv.; Aquam Camphoræ ad unciam. The dose may be administered three or four times a day.

We next return to the consideration of the use of *Creasote, Guaiacol, and allied substances in phthisis.* Creasote began to be employed in the treatment of phthisis early in the present century. It was first of all introduced in 1823, and employed in a vaporized form in cases of consumption in which there was little or no fever, and it was

even then well reported of. The plan of using it at first was not unlike that which has been quite recently resuscitated, viz., the boiling of the substance in a suitable vessel over a lamp, and in this way producing fumes which the patients inhaled. Other methods of inhalation were later on employed, viz., the slow evaporation of the creasote upon suitable cloths in the neighbourhood of the patient. From the time of its first introduction until now, creasote has been more or less in use in the cure of consumption, and it has been claimed for it by an undoubted authority that it, "alone of all the remedies which have been employed for the same purpose, has stood the test of the experience of so many years." This statement is, no doubt, true, but it should be recollected in connection therewith that creasote has not been continuously employed since its first introduction. It has had its times of popularity and its times of neglect. It has, however, been a remedy to which physicians have been prone to turn now and again after the failure of this or that remedy, which having been introduced with a flourish of trumpets as a specific, has disappointed expectation. During the past six or eight years it is an undoubted fact that creasote and the drugs directly or indirectly obtained from it have been very popular in the treatment of tubercular disease, and that at the present time their use is very extensive in this connection. We might even go a step further and say that no other drug is so popular. Its action, methods of employment, and the results which follow its use must, therefore, be of interest, and require more than a cursory notice.

Creasote is a clear, lightish brown liquid, with a characteristic odour and a strong empyreumatic taste. It is obtained by the destructive distillation of wood. Two kinds are known in the drug market, viz., that obtained

from beechwood and that obtained from pinewood. These two substances differ considerably in composition; beechwood creasote contains no less than from 60 to 70 per cent. of guaiacol, whereas pinewood creasote does not contain any, or only very little, of that substance. Both kinds are rich in cresols. Beechwood creasote is that which is chiefly employed in medicine. It is only slightly soluble in water, and this makes it a little difficult to exhibit in the form of a draught, but it is soluble in alcohol, and also in various oils. As regards the action of creasote when administered to phthiscial patients two chief views have been held. The one that, if given in sufficiently large doses, it may act as a disinfectant of the tissues and produce the death of the tubercle bacilli. It is the aim, therefore, of those who hold this view to give the drug in large doses so that a complete saturation of the system may be effected. The other view considers that the action of creasote is in no sense specific against the tubercle bacilli, but that, if given in moderate doses for considerable periods, it produces a good effect upon the system, generally of a tonic nature, whereby the tissues are able to resist more efficiently the attack of the specific microbe; creasote being merely a useful adjunct to other measures, of which the chief are hygienic, the object of which is the improvement of the general health.

It seems to be generally admitted that creasote exercises the same action in whatever way it may be introduced into the tissues.

Numerous methods have been used for exhibiting this drug:—(*a*) Most commonly it is administered by the stomach either in the form of a draught or in form of pill; (*b*) very often, however, it is used as an inhalation; (*c*) sometimes as an unguent rubbed into the skin,

especially of the chest; (*d*) occasionally by the rectum as a suppository or as an enema; and (*e*) as a subcutaneous intra-pulmonary or intra-tracheal injection. It will be as well to consider these different methods of administration seriatim.

First of all, when creasote is administered as a medicine by means of the stomach. The original method was to give the drug in the form of pills. These were made either with crumb of bread or with (Bouchard) powder of almond soap dried in the stove according to the following formula:—

℞ Creasote, 10 grms.
Almond soap powder, 25 grms.

To make 100 pilules, eight to ten to be taken daily, one every two hours, each containing 80 centigrm., or 1 grm. in the twenty-four hours.

When given in the form of pill or in gelatin capsules (another method of administering it), creasote can seldom be tolerated in any more than small doses. It is generally found to be irritating to the gastric mucous membrane. The best way to give the drug will be found, therefore, in the form of a draught, according to the formula given p. 122. If the cough is particularly troublesome there may be added to this mixture:—

Tinct. Opii, ♏v.,
or Liquor. Morphinæ Hydrochlor., ♏iii. to v.

Creasote will also dissolve well in cod-liver oil, and may be thus prescribed:—

℞ Olei Morrhuæ, drachms ii.
Creasoti, ♏v.
D. bis die post cibos.

The pharmacopœial preparation Mistura Creasoti is not popular, possibly because it contains a small amount of

acetic acid. The drug is often given on the Continent (dissolved) in wine. Of this method of administration the following formula will serve as an example:—

℞ Creasoti, grm. xiii ½.	*or* ℞ Creasoti, grm. iii.
Tinct. Gentian, grm. xxx.	Rum, grm. lxxv.
Alcohol (80°/₀) grm. cl.	Syrup Tolut., grm. lxv.
Vinum Malagæ, q. s. ad litre i.	Aquæ, grm. c.

It is quite possible, if thought advisable, in one or other form of the above mixtures to give in the twenty-four hours upwards of half a drachm of creasote without taxing the digestive powers of the patient too greatly. A larger quantity of the drug pro dosi is, however, insisted upon by those who hold to the antiseptic theory of the action of the drug. According to our experience in the treatment of large numbers of patients by this means, it is seldom necessary, or indeed advisable, to give more than twenty to thirty minims, and, generally speaking, six to fifteen minims in the twenty-four hours is a sufficient dose. Daremberg, whose account of the creasote treatment is much to be commended, states that he himself generally gives about half a gramme in the day and only in the cases in which the digestive powers are particularly good does he raise the dose to a gramme; roughly speaking this amount would be about eight to sixteen minims, or rather more. According to our experience it is useless to expect creasote to cure tubercular phthisis except indirectly. We are quite at one with those who entirely repudiate the theory that creasote acts as an antiseptic in this disease. We have no evidence sufficient to support the theory that an animal body saturated with creasote can resist the attack of the tubercle bacilli any more successfully than one not so treated (see, however, note at end of section, p. 397). From a careful examination of the results of the treatment of

many hundreds of cases with creasote we are inclined to think, although evidence in support of such an opinion is necessarily somewhat indefinite, that creasote exercises a favourable influence upon the course of many cases of phthisis. The chief good effect noticed is a decided improvement in the digestion; the tongue becomes clean and moist, the appetite, if anything, improves, and the feelings of discomfort after meals are relieved, nausea and vomiting are seldom troublesome, and constipation is an exception. We have not seen the great increase in weight which has been obtained by Bouchard; on the contrary, increase in weight to a marked degree is more common with other kinds of treatment. The cough is sometimes markedly improved, and with this improvement there is often a diminution of the expectoration. The night sweats and fever not unfrequently subside. When we have said this we have completed all that in our experience can be said in praise of the creasote treatment in consumption. No case treated with this drug could be in our opinion considered as cured by it, in no case was fever which resisted other means of treatment brought under control, nor were night sweats stopped by creasote when other drugs had been without effect. On the other hand, we are able to say that, except that some (a few) patients were altogether unable to take the remedy, no untoward symptom arose traceable to its employment, no great or fatal hæmorrhage, no marked acute dyspepsia from gastric catarrh, neither have we seen cases in which, even when the dose of the drug has been great, any injury could be traced to the administration. Many untoward events, however, have apparently occurred in the practice of others with reference to one of these supposed results of creasote treatment. We think it unlikely that the deposition of new tubercles in the lungs and elsewhere can be logically laid to the charge of this remedy. Our

own opinion on the matter is that creasote cannot be considered to be either so powerful for good or for evil as has been supposed. Its effects upon tubercular disease appear to us to have been altogether exaggerated. The marked improvement, however, which it frequently is found to exert upon the digestive processes is of considerable importance, since it enables the physician to increase the amount of nourishment given to the patient per diem, and this, taking into consideration the important part which the feeding plays in the treatment of this disease, is of much assistance.

The second method used to administer creasote to the phthisical has been already incidentally alluded to, viz., that by inhalation. Creasote either alone or dissolved in alcohol is slowly volatilized and inhaled in that way, either by means of a special respirator or in a diluted form with steam in an ordinary inhaler (see Inhalations), in a manner described elsewhere. The fumes of boiling creasote may also be used (see Creasote Chamber). In any of these ways it is possible to impregnate the inspired air with as much or as little of the drug as is considered best for the purpose in view.

The method of using creasote in the form of ointment has not been very extensively employed. It is, however, a way of introducing creasote into the system which may prove of use when the gastric mucous membrane is highly susceptible to the action of the irritation of the drug. It has been used by Daremberg and others with success. The ordinary creasote ointment of the British Pharmacopœia may be employed, but the following formula for an inunction is that which is recommended by Valentin Gilbert:—

℞ Creasoti, grm. v.
Lanolini
Adep. preparat. } aa. gr. xxv.
Ol. Oliv. j

Suppositories of creasote, containing 30 to 50 centigrammes, have also been employed, and it is said with success. In this way 60 to 70 centigrammes may be given in the 24 hours. We have had no experience of their use, and have not met with cases in which their employment would seem to have been indicated. The same remark applies to the use of enemata of creasote, which have been recommended by several French physicians. Rectal injections of creasote, containing one per cent. of the drug, are used three or four times a day. Although there is no doubt but that by this method the creasote is absorbed just as easily as from any other district of the alimentary canal, the plan has an obvious objection from its great inconvenience, and appears to possess no special merit. We next come to the method of injecting creasote subcutaneously. It was introduced with the idea that by its use creasote would more certainly be absorbed into the system than from the alimentary canal. Very good results were reported by those who first employed it. The dose of creasote was small, viz., 15 centigrammes. The drug was generally used dissolved in liquid vaseline, or in almond oil, or in neats' foot oil. The dose was soon, however, increased to half a gramme daily, and even this did not satisfy Gimbert, since, for the purpose of procuring the antiseptic action of creasote upon the whole body, he soon increased the dose to a single injection of 14 grammes under the skin. This latter plan depended upon a theoretical consideration of the amount of creasote necessary to make the whole body antiseptic, derived from experiment upon the amount required to completely sterilize a given quantity of gelatinized serum in which tubercle bacilli had been grown. Whether such reasoning is correct or not, the actual practice of injecting such a large amount

of creasote has been strongly condemned, and, as we have seen, the good effects of so doing are, to say the very least, problematical. Besides this, it has been said that as violent a fever reaction has been noticed from large injections as was produced by Koch's tuberculin. When we consider, too, that according to Gimbert no less than 60 to 150 injections are necessary to procure the arrest of the disease, it is evident that the plan, even if not dangerous, is much too unpleasant for general adoption.

The experience which we have had of the injection of creasote subcutaneously at the Victoria Park Hospital inclines us to the belief that such a method of introducing the drug is no more potent to cure the disease than when the drug is administered by the mouth.

We have had no experience of the method of intra-pulmonary and intra-tracheal injections of creasote. The reported results, however, of the use of these means have been so unfavourable that it is unnecessary to extend further the trial of such an illogical plan.

Of the use of Guaiacol in phthisis there has been a considerable amount of experience within the last few years. It is a substance which, as we have seen, exists in no less quantity than 70 to 80 per cent. in beechwood creasote. In appearance, smell, and taste it closely resembles creasote, but is more easily borne than the pure drug, being somewhat less hot to the taste and less irritating to the gastric mucous membrane. It may be given in exactly the same way as creasote, but the most usual method is dissolved in cod-liver oil (five minims to the two drachms). Its use as a subcutaneous injection has been urged by certain physicians in Germany and France, and has been specially well reported upon by Dr. Robertson, of Ventnor. From a careful examination of the reported results of this method of treatment we are obliged to come

to the conclusion that guaiacol is no more satisfactory as an injection than creasote, and that subcutaneous injections have no more advantage in producing cure of the disease than oral administrations of the drug. A mixture of guaiacol, with iodoform dissolved in sterile olive oil in proportions of 5 and 1 per cent. respectively, has been recommended by Max Schüller, 2 to 3 ccm. of this solution to be injected during the 24 hours.

Guaiacol carbonate, a white crystalline substance, derived from guaiacol, practically odourless and tasteless, has been recommended as a substitute for creasote in the treatment of phthisis. It may be conveniently given in form of a pill, and the dose may be considerable without any inconvenience. It is said to possess the good qualities of creasote without the irritating effects. The same remark is said to apply to another preparation, viz., Benzosol, a combination of benzoic acid with guaiacol. This latter is also odourless and tasteless; it contains 50 to 60 $^{0}/_{0}$ of guaiacol, and is decomposed in the stomach into benzoic acid and guaiacol. Experiments made upon tuberculous animals with these derivatives of creasote have not been found successful. We may repeat, in conclusion, with reference to the preparations of creasote, that we have seldom found it necessary to discontinue the employment of the drug from intolerance on the part of a patient, and it is only in such comparatively rare cases that it is necessary to use either guaiacol or any of its derivatives. It is obvious, if we desire to produce the effect of a drug upon the organism, that it is best in nine cases out of ten to employ the drug itself if it can be taken without ill effect.[1]

[1] Dr. Kington Fyffe has endeavoured to show that the administration of creasote by the mouth when the doses are considerable has a distinct effect in diminishing the virulence of the bacilli in the patient's sputum, and that a similar effect is produced in the sputum of those

patients who have been systematically subjected to treatment in the creasote chamber. He has also found that creasote, when injected under the skin of tuberculous guinea pigs, has a distinct restraining effect upon the action of the tuberculous poison, supposing the disease has not been too far advanced. It is possible that attenuation of the virulence of the bacilli may be brought about by the exhibition of creasote internally, but the proof appears to us to require considerable support before such a possibility can be generally received; in other words we think the number of cases used in the demonstration was not sufficient to justify any general conclusion.

CHAPTER XI.

ON THE DIET OF THE PHTHISICAL AND OF SPECIAL METHODS OF DIETETIC TREATMENT.

THE proper feeding of the sick is certainly one of the most important duties which fall to the lot of the practitioner of medicine, for without a due regard to the diet administered other attempts to benefit the patient will generally prove futile. In some diseases is this the case more than in others, and of these pulmonary tuberculosis must be reckoned one. As we have pointed out elsewhere, the most characteristic feature of the disease is the wasting of the tissues of the body, and in combatting this more is to be expected from attention to the feeding of the patient than from the administration of drugs.

The principles which should guide us in this endeavour are practically the same as those common-sense rules for the dieting of the healthy. In the first place the food which is to be given to the individual should consist of materials containing the same amounts of the chemical elements (Carbon, Nitrogen, Hydrogen, and Oxygen) and of salts and water as are eliminated in the various excreta in the given time. Of these amounts, the output of Carbon and Nitrogen is considered to be the most important guide, as the salts and water eliminated can be so easily varied. The Carbon is excreted chiefly by the lungs, in the form of Carbonic Dioxide gas (CO_2), which is the ultimate result of very complicated metabolic processes in the tissues of the nature of combustion, so

that the amount of the gas excreted is really a test of the extent and activity of the combustive processes in the muscles and elsewhere. The Nitrogen chiefly eliminated in the form of Urea ($CO(NH)_2$), the chief solid constituent of the urine, is the result also of very extensive and complicated processes in the tissues, the urea being, it is supposed, the final stage in the conversion in the body of the proteid or albumen of the food. The amount of carbon eliminated in the twenty-four hours by the average healthy adult amounts to from 250 to 280 grammes,[1] and the Nitrogen, in the same time, to 15 to 18 grammes, together with 35 grammes of salts (chiefly sodium chloride) and 2,000 (2 litres) of water. In a diet scale, then, the first requisite is that the same amount of these chemical elements should be present. This, however, is not all; it has been found by experiment that the diet should consist of certain proportions of the proximate principles, proteid, fats, carbohydrates, with salts and water. Of the proportions of each of these principles a slight variation is allowed, and different diet scales, in which these variations are to be seen, have been suggested by various authorities. A fair average diet scale would be as follows:—*Proteid* (or *Albuminous* material), 120 grammes (about 4½ oz.); *Fatty materials*, 90 grammes (about 3 oz.); *Carbohydrates* (starchy and saccharine

[1] For the sake of convenience the weights and measures in the dietaries have been expressed according to the French system. If the reader wishes to convert them into their English equivalents he can easily do so by means of the following:—One gramme = 15·4 grains, and to convert grammes into ounces, avoirdupois, multiply by 20 and divide by 567. One ounce = about 28·3 grammes, and 1 lb. = 453·6 grammes nearly. One kilogram or 1,000 grammes = rather more than 2 lbs. and 3 oz. Again, 1 cubic centimetre = about 17 minims; 1 litre or 1,000 ccm. = 1 pint, 15 ozs. 2 drs. and 11 minims. One fluid ounce = 28·4 ccm. One pint = 568 ccm.

materials), 330 grammes (about $11\frac{1}{2}$ oz.); *Salts*, 35 grammes (about $1\frac{1}{4}$ oz.); *Water*, 2,000 ccm. or 2 litres (about $3\frac{1}{2}$ pints).

These, then, are two of the principles of dieting; there is yet a third. The food materials in which these proximate principles are represented should be such that the individual may be able to digest and absorb the amount of each of them required by his tissues. The food-stuffs chosen, then, should be such as he can easily digest.

As a matter of fact, the actual amount of food taken by any person is almost certain to be more than he really requires for the replacement of his average body loss. Few, for example, are content with taking four and a half ounces of meat to represent the chief amount of proteid food in the twenty-four hours. The result of this condition of affairs is that, on the one hand, more food is taken in and dealt with by the body than is actually required, and, on the other hand, there is more waste material to be eliminated by the fæces.

Wasting is very often due to improper dieting. The food may contain the requisite amount of the proximate principles necessary, but not presented in such a form that the body in an unhealthy state is able to make use of it. That this is the case is shown by the fact that a properly regulated diet in the great majority of cases puts a stop to wasting.

When a careful attention to dieting does not result in the cessation of this symptom we generally have to do with dyspepsia, which interferes with proper assimilation of the food, with or without some gross lesion of the gastro-enteric tract, or else with some grave interference with the metabolism of the tissues. Of the dyspepsia of the phthisical we have already spoken. It may depend upon a weakness of the digestive ferments which may be

assisted by drugs, or upon some other cause also capable of a remedy. So that in some cases when wasting does not yield to dieting alone, it may do so if the dieting is assisted by the administration of suitable drugs (see Dyspepsia, p. 257).

If, however, in spite of these plans of treatment, wasting persists, we must conclude that it is due to the other possible cause, namely, to a grave derangement of the metabolism of the tissues themselves, whereby the process of taking up the food materials which have been duly digested and absorbed from the blood and building them up into their protoplasm (anabolism) is not duly performed by the tissues, or else the breaking down of the protoplasm (katabolism) is abnormally rapid. Such inherent defects in the process must probably be attributed to some disarrangement of the control which the nervous system should exercise over the process, and cannot be treated by dieting unless quite indirectly. With the exception of the last class of cases, we may look for very encouraging results from careful regulation of the diet, and even with them, if sufficient patience is used, it may be possible at last to exercise some control over the tissue metabolism. In feeding tubercular patients, then, first, we have to exhibit to our patients foods containing as nearly as possible the amounts of each of the proximate principles above indicated in our ideal diet scale; and, secondly, we have to take care that these foods are such as the patient will take and can digest. Thus when one variety of food is found to be unsuitable another and another must be tried until we find one which can be well taken and digested. Again, even if a certain diet is found agreeable to the patient it must not be continued too long; variation from time to time is essential. Naturally we do not always prescribe the same dietary for all states

of the tubercular disease. When there is fever and the disease is actively progressive, we order a diet which would be unsuitable for a patient in whom the diseased processes are quiescent or very chronic, or possibly in the course of actual cure. Hence it will be as well to treat of the dieting of patients in these two conditions under separate heads.

(*a*) **Of the Food and Feeding of the Patient when there is a marked degree of Fever present.**—By the expression *marked degree of fever* we mean in the present instance not only a condition in which the temperature throughout the day is high, never falling below, say, 100° F., but also when there is a considerable variation between the morning and evening temperature, the latter rising to 103° or more, even if the morning temperature falls to or below normal. Such a degree of fever may exist, it will be remembered, at any stage in the course of the disease, either early or late, provided the disease is active or progressive. It is also present when complications arise, and sometimes when, although the active tubercular process is quiet, there is any septic infection. The term we use —marked fever—is an entirely arbitrary one. A moderate continued fever in a late stage, when the patient has been weakened by long months of illness, must be considered almost, if not quite, as important as a higher degree of fever in an earlier stage, especially if the patient be naturally of a robust physique.

A patient in a condition of marked fever naturally passes most of his time in bed; for, although a high temperature in phthisis is not such an absolute bar to getting up part of the day as a similar temperature might be in another disease, at the same time the less a patient gets up whilst his temperature exceeds 102° F. the better.

Such being the case, the chief part of the diet should consist of liquid food. We have the best form of liquid

food ready at hand in *Milk*, and of this the diet should, if possible, be largely made up.

Careful estimates have been made of the composition of cow's milk, so that we know approximately, at all events, the nutrient value of the food when it is administered. It contains about 12·5 per cent. of solids; of these proteids (caseinogen and lactalbumin) constitute at least 4·2 parts; fatty matters constituting butter, 4 parts; carbohydrates, in the form of lactose or milk sugar, 3·8; and salts 0·7 parts. If an adult is fed upon milk alone he would require, in order to satisfy the essentials of the ideal diet above specified, nearly 3,000 ccm. or 3 litres in the course of the twenty-four hours. This would give him 120 grammes of proteid food. As, however, the metabolism of a patient lying in bed, even if the fever is high, is not likely to be so great as if he were up and exercising himself, we may diminish the amount of proteid required to 100 grammes, which would be contained in 2,000 ccm. or two and a half litres of milk, or roughly five pints. In such a quantity would also be supplied about 95 grammes of fat and 95 grammes of sugar. It would thus hardly be an entirely satisfactory diet even if the patient were content to subsist upon it solely. It is, however, a matter of very common observation that patients if pressed to take too large an amount of milk will very soon absolutely loathe it and refuse even a small quantity. It is also a fact that many people are unable to digest undiluted cow's milk. It follows, therefore, that under ordinary circumstances it is better to use milk as a partial and not as an entire diet, and to restrict the amount to two or three pints in the day, supplying the remainder of the food-stuffs in some other way.

In order to make milk more digestible and at the

same time more agreeable to the palate we have at hand several simple means. In the first place we may mix it a little at a time with soda water or with Apollinaris or other mineral water. With this addition it is found that few refuse it, and its digestion is obviously easier. The curd or casein (the chief proteid of milk) is precipitated in the stomach in smaller flakes when the milk is thus diluted than is the case with pure milk. The addition of a small amount of *brandy* to the milk (1 to 40) also has the effect of rendering it both more digestible and, to some at least, more palatable.

Again, instead of soda or mineral water, it is often a good thing to dilute milk, in the proportion of equal parts, with thin barley water or gruel. This can very well be made from Robinson's patent groats. When the mixture of the milk and gruel is sweetened, and if necessary *slightly* flavoured with some simple flavouring, such as lemon-peel, bay, or cinnamon, a patient will take it even if milk is distasteful to him. The mixture appears also to be more easy of digestion than pure milk.

A similar effect is produced if to the boiling milk a small amount of some cooked oatmeal or of some one of the patented foods, such as Savory and Moore's, Mellin's or Nestlé's be added. This method also adds to the nutrient value of the milk.

Perhaps the best of all ways of adding to the milk the necessary farinaceous or carbohydrate material is by the addition of arrowroot, which is said to be about the purest starch there is. It is of importance that the best Bermuda arrowroot should be used, as much of the so-called arrowroot is nothing more or less than potato flour or starch. The proportion of this substance to be employed is about two teaspoonsful to half a litre of milk.

Some of the milk to be used in the course of the day

may also be given in the form of custards or puddings made with such farinaceous substances as ground rice, sago, semolina, tapioca, or maccaroni, all of which supply an additional proportion of carbohydrate material which pure milk lacks.

In the foregoing remarks about milk our attention has been exclusively directed to cow's milk, since this is the most likely kind to be obtained. We must not forget, however, that in point of chemical composition, and it is said in digestibility, the milk from the ass or goat is to be preferred, as approximating more nearly to human milk, which is the natural diet. Asses' milk is poor in solids, only containing 1·7 per cent of proteid, 1·3 of fat, and 4·5 of milk sugar. Goats' milk is in composition nearer that of the cow, but contains more fat and less albumen; it has a peculiar and characteristic odour and flavour. Indeed, to appreciate goat's milk requires an education. (To the special preparations of milk, such as whey, buttermilk, koumiss and kefyr, we shall allude under the head of Special Dietetic Treatment.)

As another source of the albumen which we must supply to our patient we must next mention *Eggs*. It is seldom advisable to allow eggs to be eaten cooked, at any rate when the fever is high; under such circumstances the yelk only is employed, beaten up either with milk, wine (sherry is the best), or brandy (the yelk of an egg weighs on an average 16 grms. as against 27 grms. of the white, and consists of rather more than 16 per cent. of albumen and 31 per cent. of fat, so that roughly speaking a single yelk supplies about 2½ grms. of albumen). Few people, even in health, are able to digest many eggs in the twenty-four hours, hence we cannot expect more than two or three to be taken by a patient spending most of his time in bed. The yelks of eggs may be given in the light

custards, or milk puddings, to which we have already alluded.

It is seldom that we are able for any length of time to supply all the proteid required in a diet for our patient merely in the form of milk and eggs. Patients are so easily tired of such a sameness of material, and as we have before us in the treatment of the phthisical possibly weeks or months of fever, with or without intermission, it behoves us to be able to provide some other means of administering albuminous substances. It is only exceptionally that we can give meat, or even fish, and so we have to fall back upon the somewhat unsatisfactory extracts of meat we are able to obtain. Of these that which is most commonly employed is the home-made *Beef-tea.* The unfortunate fact with reference to beef-tea is that it has no certain composition and only very uncertain nutrient value. As a rule it is made at too high a temperature, by which the albuminous substances in the beef are coagulated, and the extract contains very little else than gelatin, salts and extractives. It thus has arisen that various preparations have been introduced with the object of preventing this diversity of composition. Nearly all of these, however, are very weak in proteids. As the greater portion of the proteid of meat consists of substances of the globulin class which are coagulated at a low temperature and which are soluble in a 10 per cent. solution of common salt, it would seem best to employ little heat, not above 50° C., in the preparation. Salt should also be employed in the water used for the extraction.

A strong beef-tea may be made thus: lean shin of beef is thoroughly freed from fat and connective tissue, it is then cut up into small pieces about the size of dice and placed in an earthenware vessel, "Pipkin," provided with a lid which can be tightly closed, with the addition of salt and

with or without a little water (an ounce to a pound). The closed-in vessel should then be put into a saucepan in water. The saucepan and its contents may be placed upon the kitchener, but some distance from the fire, and the water from time to time renewed; the temperature should not exceed 70° C. In the course of from two to twelve hours, the vessel containing the beef may be opened and several ounces of highly concentrated beef-tea is obtained. This contains a fair amount both of albumen and gelatin (about two per cent. of albumen, peptone and gelatin, and 3·69 per cent. extractives, 1·73 salts).

Of the preparations [1] which are said to contain

[1] *Various preparations of Meat which may be of service in varying the dietary of Consumptives.*—In addition to those preparations containing a large proportion of proteid material which have been referred to in the text, there are several others which may be mentioned as very useful in providing changes of diet, which, as we have seen, are so essential to the proper feeding both of the well and the sick.

Scraped Meat.—Scraped or pounded raw meat is more employed on the Continent than it is in this country. It is, however, of considerable service in some cases of phthisis, especially when there is diarrhœa, and it is at the same time necessary to exhibit an easily assimilated proteid food of a concentrated kind. It is said to be particularly digestible. It is also much used in the wasting affections of children. The very finest raw beef is taken and entirely freed from connective tissue, it is then scraped, torn with forks, or pounded in a mortar until all the fibres are thoroughly broken down. It then forms a semi-solid, pappy material which is administered to the patient as a sandwich between two pieces of thin bread and butter, after having been thoroughly sprinkled with salt and pepper if necessary. Of course every care is taken that the meat is derived from healthy animals. Sometimes ham treated in the same way may be tried, but as a rule it is not nearly so digestible.

Sweetbread.—This, as is well known, either the thymus gland ("throat sweetbread") or the pancreas ("stomach sweetbread") possesses the two important qualities of being very rich in proteid and at the same time possessing a high degree of digestibility. The amount

albuminous materials from meat, the only ones which can do so are those obtained from meat by expression, and these, since they are necessarily made from the raw meat, taste too much like it to be pleasant. They cannot, how-

of proteid is upwards of 22 per cent., whilst the fat is very small, viz., 0·4 per cent. The sweetbread may be used broiled, or stewed in stock, but it may also be made into a pappy soup for those patients who are unable to take solid food as it is easily broken down.

Tripe, well boiled so as to be very tender, may also be given sometimes if the patient fancies it. It is both digestible and nutritious.

The relative merits of the different kinds of meat have been much discussed, and mutton is generally assumed to be that which should be taken by invalids such as consumptives. This is no doubt true, and this variety may form the mainstay of the meat diet when suitable. Beef is seldom well digested unless particularly tender and high class. Veal, which is generally thought to be indigestible, when from very young animals is much better borne by invalids than beef, and, indeed, it is more tender and poorer in fat than the meat of the adult animal and may certainly be tried. Fat meat of all descriptions must be carefully excluded from the diet. Pork and swine meat altogether is seldom available, and whilst chicken, young pigeons, partridges and similar birds are eminently suitable, the flesh of ducks, geese, turkey, woodcock, is to be avoided.

Meat Extracts and Juices.—The extract of meat with which we are most familiar is said to be made by exhausting the meat in cold water to avoid dissolving the fat and gelatin, separating the watery solution by filtration, heating to boiling to coagulate the proteid, removing the coagulum and finally concentrating the residue. Such an extract naturally contains very little proteid, and the solids are chiefly salts, and such nitrogenous crystalline bodies as kreatin. It is obvious that this preparation has little nutrient value; it is, however, valuable as a stimulant and may often be added to soups with advantage. It contains some principles agreeable to the taste, and so is very palatable.

Pavy's Beef-tea is thus made: "Mince finely a pound of lean beef and pour upon it, in a preserve jar or other suitable vessel, one pint of cold water, stir, and allow the two to stand about an hour, that the goodness of the meat may be dissolved out. Next stand the preserve jar, or other vessel, in a saucepan over the fire or gas stove, and allow the water in it to boil gently for an hour. Remove the jar and pour its contents on

ever, be given except in a slightly tepid condition, or the albumen would be coagulated.

We must not forget, however, that in giving extracts of meat, so-called, we may benefit the patient in another way

to a strainer. The beef-tea which runs through contains a quantity of fine sediment, which is to be drunk with the liquid, after being flavoured with salt at discretion. Beef-tea thus prepared represents a highly nutritious liquid with an agreeable rich meaty flavour." Chicken, veal, or mutton may be similarly treated.

Extractum Carnis Frigide preparatum, or Liebig's Beef-tea, is made by extracting meat in the cold with water to which a few drops of hydrochloric acid have been added (200 grm. meat to 250 ccm. of water and 3 (!) drops of acid). After standing for an hour it is strained. and the meat further washed with 100 cem. of water. The mixed food is taken either cold or only slightly warmed. It has a disagreeable taste of raw meat and contains only 1 per cent. proteid. *Succus Carnis* (Pettenkofer and Voit) contains a large percentage of proteid, no less than 6 per cent. Perfectly fresh and good meat is cut up, arranged in layers separated by layers of coarse muslin, and then subjected to strong pressure. From each kilo of meat about 250 grm. of blood-red juice are obtained. This juice tastes strongly of the raw meat. It must not be warmed above 40 C. It may be a useful preparation if flavoured with extract of meat and salt, but without such flavouring is repugnant to a delicate stomach.

Peptone, that is to say, the ultimate product of gastric digestion, and one of the products of pancreatic digestion, although theoretically of great value as a highly nutritive food, is little used. Nearly all the peptones in the market have a disagreeable taste, and at the best glue-like smell. The most used are Koch's and Kemmerich's. The former contains 24 per cent. peptone; 17 per cent. proteid, other than peptone; 7 per cent. nitrogen in other forms, and 7·3 per cent. salts. It may be taken dissolved in hot water flavoured with salt. The former is not much liked by patients, but Kemmerich's, which contains 10 per cent. albumen and 37 per cent. peptone, is said to be very easily taken and even relished.

In this connection it is necessary to mention several much-used meat preparations which are in the market. First of all *Valentine's Meat Juice.* This is said to be a preparation of prime beef evaporated at 55° C. in vacuo. We have found it useful in the feeding of invalids, although

besides giving him a varying small amount of albuminous material. The water in which meat has been boiled for a greater or lesser time contains not only a small amount of gelatin, but also the extractives of the meat, so that it

its nutritive value is not high. It is said to contain about 1 per cent. of proteid only. Considering its poorness in proteids it is an expensive preparation. *Brand's essences of meat* of different kinds are also a useful series of preparations. They seem to be of the nature of concentrated meat extracts and contain albumen and gelatin. Patients will often take these extracts cold between two slices of bread-and-butter. *Bovril* is another form of meat extract; it is said to contain considerably more albumen than Valentine's preparation, but in its ordinary form some aromatic flavouring is added, which somewhat interferes with its use as a remedy for invalids. Recently, however, we believe a form of bovril is made free from this objection, and suitable for the sick.

Of Broths and Soups.--Broth is an extract of meat obtained by the action of prolonged heat. The meat, whether it be beef, mutton, veal, chicken, or any other kind, is boiled for a longer or shorter time in water, by means of which action an extract is made. This extract contains the gelatin, the salts and the extractives of the meat and possibly a little peptone if the action is a prolonged one. The broth thus obtained may or may not be flavoured with some such vegetables as carrots, turnips, or merely with celery or its seed. As such the broth is not of a high nutritive value, but is stimulant in its effect and acts as what the Germans call a "Sparmittel;" it will not take the place of proteid food altogether, but will do so in part. From these meat broths soups are made by the addition of milk, yelk of egg, sago, oatmeal, rice or the like. Meat broth, however, is not always used in making soup, as milk alone or ther such material may be used instead.

Of Gelatines and Jellies.—The purest form of gelatin is isinglass obtained from the bladder of the sturgeon. It was formerly much used as the basis of blanc manges and jellies. Many other forms of gelatin are, however, now employed, of which Nelson's is the best known. The finest gold label (French) gelatin is also much used. For invalid cookery, however, it has always been considered the best plan to obtain the gelatin, which is to form the basis of the jelly, fresh from meat, and cow's heel or calves' feet are the chief sources of supply. The latter is especially popular.

not only acts from its own contents as a stimulant in the same way as those commercial extracts such as Liebig's, but also forms the basis or "stock" for the production of excellent nutritious soup.

Mutton or veal boiled in this way, or chicken, is more

A form of strong jelly is made thus:—(Wiel) Four calves' feet (small), two pounds of beef, and a chicken (an old fowl will do) are cooked in five litres of water and 15 grammes of salt. For the last hour of the boiling a small pike or similar fish is added. The broth is allowed to stand so that the fat may be removed, and when this is done it is cleared by the addition of the whites of six (!) eggs and boiling. It is filtered through a damp cloth, and to the filtrate 20 grammes of extract of meat are added. The mixture gelatinizes on standing in a cool place.

A wine jelly much appreciated by some patients is made in the following way:—Fifteen grammes of gelatin (or isinglass) are dissolved in 300 ccm. of hot water. To this solution is added 20 ccm. of lemon juice and 50 to 75 grammes sugar and then wine. If sherry or port, about 30 to 40 ccm.; if Rhine wine, 50 to 60 ccm.; or if cognac, 5 to 10 ccm. The ingredients are thoroughly mixed, and the solution is allowed to cool in a suitable mould until gelatinized.

In prescribing soups and jellies it must always be remembered that gelatin cannot replace the whole, but only part of the proteids of the food.

Of so-called Peptonized Foods.—Attempts have been made in certain extreme cases of imperfect digestion, and in obstinate vomiting, to predigest the food administered. This is usually done by the addition of some pancreatic extract, and the preparation generally employed is the Liquor Pancreaticus (Benger), or the Zymine Peptonizing Powders (Fairchild). By the use of these or similar materials, milk, gruel, etc., may be digested to a certain point before the patient takes it, the albuminous constituents being partially converted into albumoses and peptones. There are, however, objections to this plan of treatment, the first being the unpleasant taste of the resulting product, very difficult to mask, and the second the doubtful nutritive value of peptone and albumoses. When the liquor pancreaticus is used about a teaspoonful is added to the pint of warm milk, somewhat diluted with water. The mixture is kept in a warm place for a couple of hours, more or less, and is then boiled, the latter proceeding being necessary in order to stop the ferment action before it proceeds too far.

often used than beef, and the broth so obtained may be strengthened by the addition of milk, egg, ground rice, sago, and so on. Some well-powdered leguminous flour of lentils, such as the revalenta arabica,[1] or of peas or beans, may be added if the digestion is not weak, or even mashed potato in small quantities.

We find, however, that vegetable albuminous material (legumin) is not as a rule available for feverish patients, since it appears to generate flatulence, even when taken in such innocent forms as those just mentioned, probably from the associated starch.

Next as to the best way in which to exhibit the carbohydrate materials, which are deficient unless the diet is made up of milk only, which appears to supply all that is required when taken in sufficient quantity.

We have already alluded to the starchy preparations which are added to milk in order to increase its palatability, such as sago, rice, tapioca, arrowroot, and the like. Bread in some form or another, however, is seldom contra-indicated. Bread and butter, too, may nearly always be given, and patients who have scarcely any appetite for solid food will take bread or toast sopped in their soup, milk, cocoa, tea or coffee with gusto.

When giving bread we should not forget that although by so doing we are supplying carbohydrate food, we are also adding to the proteid six to eight per cent. as against 45 to 55 per cent. of carbohydrate. Two ounces of bread per diem, or about 60 grms., would be ample to allow for a patient in the condition of which we have been treating.

[1] Revalenta Arabica is a beautifully ground flour, which is said to be made up of lentil, with pea, bean, and maize meal, and sometimes apparently with that of oat and barley added. It is highly nitrogenous, *i.e.*, contains a large proportion of albumin, nearly 25 per cent.

It is nearly always necessary to add some *stimulant* to the above diet.

Of such substances as Tea, Coffee, and Cocoa we have already incidentally spoken. It may be added that they, one or other of them, have a tendency to relieve the dull monotony of invalid diet, and as such may be used. They must, however, be employed with care and given in great moderation. Tea and coffee are not of themselves of any nutrient value, but are stimulant from containing the alkaloids Thein and Caffein respectively. Both are said to diminish the appetite. As regards cocoa it is not only a stimulant from the presence of Theobromin, an alkaloid very similar to thein, but also a food from the presence of 10 to 15 per cent. of nitrogenous matter, a very large proportion of fat (no less than 40 to 50 per cent.) and 10 to 15 per cent. of carbohydrate material. It thus must take its place among foods proper. The disadvantage of cocoa is that the taste is not so much liked as that of tea or coffee, and from the large proportion of fat it is felt by some to be too rich, especially in the way in which it is usually given, viz., dissolved in hot milk. Of the preparations of cocoa which appear to retain the advantages and to have rejected the disadvantages of the cocoa berries, we would place the Extract of Cocoa prepared by Messrs. Fry, the Essence (Cadbury), Van Houten's Cocoa, and Cocoatina. All of these preparations may be so made as to closely resemble tea.

Of alcoholic stimulants,[1] it is usual to give wine, such

[1] The question of alcoholic stimulants, whether in the early or later stage of phthisis, is not an easy one. Even if, as in the state of fever, stimulants are obviously indicated, it is not unfrequently a difficult matter to select the exact kind to be administered. To a patient spending most of his time in bed the usual variety of stimulant given is either Port or Brandy, as we have already mentioned. Sometimes, however, for some reason or another neither of these can be taken. As

as port, since, as a rule, patients prefer wine to spirits. If the fever is high or the condition of the patient is anxious from any cause, we prefer to administer brandy or whisky. The quantity and mode of administration vary in each case. Three to six ounces of wine or four ounces of brandy in the course of the day and night will usually be found sufficient. It is best to give the spirit mixed with milk or similar food, and the wine may either be taken pure or in the form of egg mixture, with sugar and spices. Our own experience is that few patients are able to take such wines as claret, or those in which there

substitutes for brandy it is generally possible to prescribe whisky, rum, or (in selected cases) gin. The difficulty rather arises with respect to a substitute for port. Our own opinion is strongly in favour of sherry as a usual alternative to port. Of this wine Pavy very truly says:—"A pure and dry Sherry may be said to constitute one of the most wholesome liquids for general use of the fermented class. It is devoid of astringency, and has not the strength-giving properties of port, but forms a wine which may be drunk when other wines disagree." The percentage of alcohol in sherry is much the same as that contained in port, viz., about 35 per cent. Marsala, a Sicilian wine of good body, is somewhat similar to sherry, and of about the same alcoholic strength. The chief property which port, sherry, and marsala possess over and above the so-called lighter wines is that there is comparative freedom from free acid, whereas Rhine wine, Moselle, and Clarets contain an excess of acidity which renders them less fit for persons in whom the powers of digestion are weakened. We must, however, remember that even in England, where it was formerly possible to obtain very good sherry, this wine is now little drunk and so less likely to be obtained good and comparatively cheap. The modern sherry, too, is less alcoholic and more like a natural wine than was formerly the case. On the Continent sherry is scarcely ever drunk. When a patient is away from home, staying at some foreign health resort, it is generally best to use cognac, but if wine is required, full-bodied claret containing about 20 per cent. of alcohol, or good Burgundy or some sound red Rhine wine may be taken. Speaking generally, however, thin or acid wines of all kinds should be avoided. The *vin ordinaire* is seldom of sufficient "body" to suit the requirements of the consumptive patient.

is much free acid, in this condition, but dry Sherry, good Madeira, or Marsala may sometimes be substituted for port.

It will be as well to add an outline sketch as to the way in which the different food-stuffs of which we have spoken may be given in the course of the twenty-four hours, but we would lay stress upon the fact that it is only one way, and that other ways may under different circumstances be better.

Dietary for a patient spending most of the day in bed.

At 7 a.m., half-a-pint of milk with two teaspoonfuls of cognac, or rum if preferred.

At 8.30 a.m., a breakfast cup of hot coffee, cocoa, or tea, made with half-a-pint of milk and a sufficiency of sugar. With this may be given two or three small slices of bread and butter or some dry toast to sop in the coffee.

At 11 a.m., half-a-pint of hot beef-tea with toast, or if preferred half-a-pint of milk and soda-water or a corresponding amount of arrowroot, etc.

At 1 p.m., half-a-pint of beef-tea with sago or rice, or mutton, veal, or chicken broth. Custard or milk pudding and a glass of wine (two ounces).

At 4 p.m., a breakfast cup of milk-coffee (half-a-pint of milk), with bread and butter or toast.

At 6 p.m., a cup of milk (half-a-pint) with half-an-ounce of cognac.

At 8 p.m., half-a-pint of beef-tea or meat broth, and a glass of wine (one to two ounces).

During the night, if the patient be thirsty, half-a-pint of milk and soda-water.

Such a diet as the above summarized comes to the following :—Milk two to two and a half pints, say 1,500 cc. or

a litre and a half, supplying, therefore, about 60 grms. proteid, 50 to 60 grms. of fat, and 80 grms. carbohydrate (with salts and water). Meat extract or broth, one and a half pints with thickening, say 1,000 cc. or one litre. This should supply 30 to 40 grms. proteid, 20 to 25 fat, and 120 to 150 carbohydrates, and the egg used in making the custard and the small amount of bread and butter should bring the total as nearly as possible to—Proteids 100, Fats 80 grms., Carbohydrates 250 grms., with salts and water, supposing the whole be taken, but allowing one-third waste we should arrive at a fairly satisfactory diet scale for a person suffering from tubercular disease of the lung in whom the fever is moderately high. In this we have not included the stimulants, such as tea, coffee, cocoa, and alcohol. The nutrient value of these cannot well be measured. Oysters may be given, too, and are much relished even by feverish patients. They should be of the best kind and quite fresh.

Before leaving this section we must mention that the above suggested diet *requires to be modified*, first, if the fever increase, or if the patient from any cause becomes worse, and, secondly, if the fever is abating, although not gone, and the patient's appetite and strength improve.

Under the former conditions it is nearly always advisable to restrict the diet to milk, with or without mineral or soda-water and brandy. Meat broths and extracts are seldom well taken. Here, however, it is sometimes possible to supply in addition an amount of nitrogenous food in wine, jellies, *e.g.*, calf's foot (see note, p. 410) or as cold and gelatinized beef-tea. It is a remarkable fact that many patients who will not touch beef-tea, warm or liquid, will take it with some zest as a jelly, especially if there be a strong flavour of salt with it.

In the latter case, when the patient is getting beyond

what is often succinctly called "spoon food," we may add to the diet above sketched out a lightly boiled egg for breakfast, and some well-boiled white fish, such as sole or cod, for dinner, at 1 p.m., and we may omit one pint of milk and half-a-pint of beef-tea or meat broth. The sequence of the meals, however, may be maintained. When the patient is able to take meat for his dinner he comes into our second category, to the consideration of which we shall now proceed.

(ii.) **Of the Food and Feeding of the Patient when the Fever is not marked.**

(*a*) *When the digestion is good.*—While still relying to a considerable extent upon the food-stuffs we have indicated in the preceding section, and particularly upon milk, we are now allowed a much larger range of substances than in the former case. We have also to recollect that as the patient is now "up" for the greater portion of the day, and may indeed indulge in a considerable amount of exercise, the tissue changes may be even greater than when fever, unless very excessive, is present, and so we must supply food in sufficient amount accordingly.

Commencing the day, then, as regards his food, at 7 a.m., he may take a good large glass of milk, to which two to four teaspoonfuls of cognac may or may not be added as occasion requires; he may postpone his second meal until he has dressed, and take it at 9.30 to 10 a.m. This second meal should be substantial. It should consist of a large cup of coffee and milk, or of cocoa made with milk, bread and butter, a couple of sardines in oil, or one or two rashers of bacon, and an egg. There is no objection to add to this meal some fresh ripe or preserved or stewed fruit. At 11 to 11.30 he should begin to take his out-of-door exercise if the weather is suitable, re-

turning home at 12.45 p.m. to prepare for his dinner at 1.15 to 1.30 p.m.

This dinner should consist of a plate of soup (see note, p. 410), such as sago, rice, maccaroni, or the like, a couple of good slices from the joint, such as roast mutton, well-cooked young veal if in season, beef (if the digestion is particularly good), or a little chicken or game, with thoroughly well-boiled green vegetables, such as cabbage, cauliflower, peas or beans when in season, and one medium-sized potato[1]. A milk pudding, such as rice, tapioca, or the like, or well-stewed fruit in moderate amount, with bread and butter. It is seldom that cheese may be permitted. Instead of the soup on alternate days, or less often, he may have a portion of well-cooked fish,[2] and white fish is to be preferred if a choice is allowed.

[1] Meat which has been salted, pressed, dried, or smoked should be avoided. Tinned meat, such as tongue, ham, and all potted meats should also be advised against. Recooked meat, such as hashes, stews and fricassees, mayonaises, creams, elaborate pastry, and other "triumphs of the confectioner's art," are very likely to produce indigestion.

[2] There is considerable difference between individuals as to the use of fish in a diet. Whilst some are able almost to live upon fish, others "never eat it if they can get anything else." The nutrient value of fish, too, is a matter of discussion. Although, according to the chemical analysis of different kinds of fish, it is obvious that they contain less proteid than beef or mutton, yet the difference is not so great as is usually thought, viz., 13 to 18 per cent. against 16 to 20 per cent., and by large populations in fishing communities the staple article of diet is fish, and the fisher class are proverbially strong, robust, and healthy.

The best fish for the invalid are: the *sole*, which is not only a fish which never palls upon the appetite, but is tender and digestible; it possesses a fine sweet flavour; the *whiting*, said to be the most digestible of fish, "the chicken of the fish tribe"; the *haddock*, somewhat similar, but not so tasty or digestible. Next come the *cod*, not so indigestible as is usually thought, and varying greatly both in taste and

At 4.30 he may have afternoon tea or coffee, with bread and butter, and at 6.30 to 7 should have his last substantial meal, which should include some meat-broth or beef-tea and bread. With his dinner he may take a glass (half-a-pint) of sound bitter ale, and with his supper he may have a second glass of ale or a glass of wine. At 9 p.m. before going to bed he may require a glass of milk with or without a couple of teaspoonfuls of cognac.

As there is very likely to be an appetite which requires humouring it should be the object of the attendants to vary the diet from day to day as much as possible.

It must be remembered that between dinner and tea there should be as much exercise in the open air as possible, and after tea in fine weather during the spring and summer the patient may usually stay out until his supper at 6.30 to 7 p.m.

In the above sketch we have assumed that the patient is both able and willing to carry on the scheme of diet

tenderness; the *plaice*, which requires to be very fresh and well cooked, otherwise a very watery fish; the *turbot*, a less digestible but delicately flavoured fish, said to improve slightly on keeping for a longer time than most fish.

Of these fish the invalid, whether in an early or late stage of phthisis, may partake. They should be boiled and not fried.

The *following fish should be avoided if there is any tendency to dyspepsia*: The *salmon* (containing 5 to 6 per cent. of fat), the *mackerel*, the *eel* (13 to 14 per cent. fat), the *herring*, *sprat*, and *pilchard*. All of these are very rich in fat, and therefore are unsuited to most invalids unless their digestions happen to be remarkably strong and good, in which case these fish, with the possible exception of the salmon and eel, may be used in small amounts. Lake *trout*, which approaches the salmon in composition, is seldom available for anyone with a delicate stomach, although it is a delicate and tasty fish, when fresh.

Generally speaking, fish which has been smoked, salted, dried, or pickled is to be avoided by the phthisical patient. They are mostly very difficult of digestion. Potted fish also is not to be recommended.

which is the best for him; we must, however, remember that various circumstances may interfere with his ability to follow out such a simple mode of life, and moreover those patients who do not feel particularly ill may be unwilling to give up their ordinary way of living. This is chiefly the case with respect to the relation of the lunch and dinner; some are unwilling to make the chief meal a mid-day one, and retain their fondness, acquired by habit chiefly, for an evening dinner. If, therefore, we meet with such cases, and we think that the habit or the opportunity for the evening meal is not absolutely contra-indicated—in which case we must insist upon the change of habit—we may give way and allow the evening meal to be taken at 7 or 7.30, and to be of a more substantial quality than the simple one we have indicated above. In such cases fish or soup may precede the meat, chicken, or game, which may be followed by some light pudding or jelly. A greater relaxation of the rule than this we should consider most unadvisable.[1]

[1] The following dietaries are given by Drs. Munk and Uffelmann in their very useful handbook of dietetics ("Die Ernährung des Gesunden und Kranken Menschen," 1887), for patients affected with tuberculosis. They are useful for the sake of comparison. Speaking generally, they agree with the diet suggested in the above.

Diet (I.)—For patients who are able to take solid food in small quantities only.

In the morning.—At 7 o'clock, one glass of milk (250 ccm. and 5 ccm. cognac) with 60 grm. toasted bread. At 8 o'clock, one cup of cocoa and milk (180 ccm.). At 10 o'clock one glass of milk and cognac, as at 7 a.m.

At mid-day.—One cup of meat broth with yelk of egg, 150 grm. rice milk, and one glass red wine ("good Bordeaux wine.")

In the afternoon.—At 4 o'clock, milk, coffee with sugar (150 ccm.), and 60 grm. toasted bread. At 6 o'clock, one glass of milk and cognac as before.

(*b*) *When the digestion is disordered.*—We have little doubt but that in a considerable proportion of cases much of the wasting in the course of tubercular disease of the lung depends upon the inability of patients to digest the food which is put before them. This is sufficiently evident from the almost certain cessation of the wasting or even

In the evening.—At 8 o'clock, one plate (300 ccm.) of milk soup with 60 grm. toast.

In the night.—One glass of milk (200 ccm.).

Diet (II.)—Alternative.

In the morning.—At 7 o'clock, one glass of milk with cognac and 60 grm. toasted bread. At 8 o'clock, one cup of sweet coffee and milk. At 10 o'clock, one cup of meat broth and egg yelk.

At mid-day.—One plate of sago soup with wine, mashed potato, 80 grm. scraped raw ham, and a little plum jam.

In the afternoon.—At 4 o'clock, one cup of coffee and milk with 50 grm. toasted roll and butter. At 6 o'clock, one glass of milk and cognac.

In the evening.—At 8 o'clock, one plate of malted leguminous meal soup with extract of meat, one roll and butter, and 50 grm. scraped ham.

The *nutrient value* of these diets is the following:—

Proteid, 92 to 105 grm.
Fat, 85 to 94 grm.
Carbo-hydrate, 220 to 250 grm.

Diet (III.)—For tuberculous patients in a chronic (febrile) state who suffer only slightly from dyspepsia, and who are slowly increasing in weight.

In the morning.—At 7 o'clock, one glass of milk (180 to 200 ccm.) and 60 grm. toast. At 10 o'clock, one cup of meat broth and yelk of egg with 80 grm. white bread and butter, and 30 grm. scraped ham or 50 grm. roast chicken. At 12 noon, one glass of milk.

In the afternoon.—At 1.30, one plate of soup (either wine, meat or vermicelli), 120 grm. roast meat, with rice or mashed potato or green vegetables, 40 grm. toast and cheese or ripe fruit, one glass of red wine. At 5 o'clock, one glass of milk and 50 grm. biscuit.

the making up of the diminished weight when the diet is carefully regulated by the medical man. We see this over and over again in hospital cases. Patients in a state of extreme emaciation not proportionate to the actual disease of their lungs, when admitted to the care of the hospital ward begin almost at once to put on flesh. These patients

In the evening.—At 8 o'clock, milk soup with wheat meal, rice or oat meal, or weak tea and milk, together with 80 grm. white bread and butter, 50 grm. cold roast meat, or 30 grm. cheese, or 35 grm. smoked ox tongue.

At night.—One small glass of milk.

Nutrient value.

Proteids, 121 grm.
Fat, 86 grm.
Carbo-hydrate, 350 grm.

The Dietary for Chronic Tubercular Patients in the Falkenstein Health Institute is, according to Dettweiler ("Die Behandlung der Lungenschwindsucht," 1884, 2 Auflage).

In the morning, between 7 and 8, good coffee, tea or cocoa, according to circumstances, with biscuit and butter or roll and butter, soft, and not too fat pastry, as much as sufficient. A glass of milk to be taken in little sips.

At 10 o'clock, one or two glasses of milk taken in the same way, or a little bottle of koumiss, and bread and butter. If specially indicated, soup with egg and bread and butter or cold meat, bread and butter and a glass of wine. Another glass of milk then if possible.

At 1 o'clock, the patients to take their part in the usual courses of the dinner, *e.g.*, roast meat, vegetables, and dessert, with wine, or wine mixed with mineral water.

In the afternoon, at 4 o'clock, one glass of fresh milk or koumiss, or bread and butter, with wine or cognac.

In the evening, at 7 or half-past, a warm meat supper with potatoes, rice, maccaroni, a slice of cold meat, fine sausage, chicken with salad and compote and wine.

Late in the evening, a glass of milk with five teaspoons of cognac.

Supposing there occur intercurrent attacks of catarrh of the stomach, as long as the attack lasts the diet is changed to liquid or semi-liquid substances.

are frequently found to be suffering from dyspepsia of most marked degree, loss of appetite, severe stomachic pains, chiefly after food, foul tongue and constipation. Although these symptoms certainly require treatment, and yield to such, yet much more good is done to them by a careful regulation of their food, both as regards quality and quantity, as well as times of administration.

When there is much emaciation and evident symptoms of indigestion, it is as well at first to treat them as though they were suffering from fever, although their temperature may not be much above normal. They should be kept in bed and fed in the way indicated above for feverish patients. Indeed, the diet should for a time consist of spoon food only. Sometimes, unfortunately, in these cases the patients have a great dislike to milk. Under such circumstances we may try the various simple methods indicated to make this almost necessary constituent of

In the morning early, tea or coffee with toast, or a glass of milk. At 9 o'clock, a glass of milk. At 10 o'clock, yelk of egg soup. At 11.30 a glass of milk and a biscuit. At 1 p.m., vegetable meal soup, ground meat, and one soft cooked beefsteak à la Tartare. At 3 p.m., a glass of milk with biscuit. At 7 p.m., chicken or vegetable meal soup, and one or two slightly boiled eggs. Late in the evening, a glass of milk and cognac.

Besides this, one or two glasses of Bordeaux wine at mid-day and in the evening.

Dettweiler observes that patients who are supposed not to be able to take meat as they have an aversion to it, really only object to hot meat, and will often take cold meat.

Supposing a high degree of anorexia to be present, a very large number of soups are available in order that the patient may have frequent changes, such as meat, bread, gruel or meal soups with or without yelk of egg, with or without extract of meat, leguminous, lentil, bean, and pea soups; spoon foods made of rice or "grits" meal, spongy egg food, gelatinous substances, raw beefsteak in wafers, fine pounded smoked meat, oysters, sweetbreads, wine creams, beef-tea.

their diet more digestible and palatable. When this is not possible we must have recourse to beef-tea and meat broths.

When the emaciation has yielded to treatment and the dyspepsia is relieved, the patient may, as a rule, be placed upon a diet such as we have indicated in our last section, but if the dyspepsia is only temporarily relieved it becomes necessary to draw out a somewhat modified diet scale for him. While fully agreeing with the axiom recently laid down by a writer on gastric catarrh (Prof. Ewald) to the effect that "every experienced physician who has much to do with dyspeptic disorders will sooner or later stop writing dietaries and be guided by the experience of his patient," we must, nevertheless, recognize the fact that the experience of the patient is not always trustworthy. It becomes the duty of the practitioner to lead as well as to follow the fancies of his patient, and hence we are of opinion that, after all, rules for diet and for the daily meals are really valuable for the patient. Hence we will shortly indicate the lines upon which we think such rules should be laid down.

In the first place a patient who is suffering from tubercular disease of the lung, and is at the same time suffering from dyspepsia, or has a tendency thereto, should be recommended to give up a heavy dinner in the evening; he should be recommended to take his largest meal between 12.30 and 1.30 p.m., should eschew "made-up" dishes of all sorts (see note, p. 418); should abstain from sweets, pastry, things fried in grease, from uncooked fruits and vegetables and from cheese. He should prefer boiled to roast or broiled meat; should abstain from beef and swine flesh, including ham and bacon. These, however, are only very general rules, and are not like the laws of the Medes and Persians; they may be relaxed

or altered according as the medical man thinks necessary.

On rising in the morning, if the bowels are inclined to constipation, a wine glass of some natural aperient water, or two teaspoonfuls of Carlsbad salts in a tumbler of hot water, may be taken.

It must always be recollected that there is a tendency among some consumptive patients to eat *too much*. When this is the case a considerable proportion of the indigestion which afflicts them may be removed by regulation and diminution of their diet. On the other hand there are some patients with chronic phthisis, to whom attention has already been directed, who require an extremely small amount of food, and to whom a copious diet would be altogether unsuited. In such instances it will, of course, be necessary to cut down the amounts of the different food-stuffs in a way which suits the requirements of the individual.

Of Special Methods of Dietetic Treatment.—Various methods have been suggested for the treatment of pulmonary consumption by means of the exclusive or almost exclusive use of a particular form of food. Under this head are included the grape cure, the milk cure, the whey cure, and the Koumiss cure. To each of these so-called cures we propose to devote a short time. As regards the *Milk Cure* first of all. The exclusive use of milk as food in various diseases is by no means a modern idea, but the systematic employment of such a method of treatment appears to be about 50 years old or rather more. The system as practised upon the continent consists in giving at first half to a whole coffee cup of skimmed milk at regular intervals during the day, *i.e.*, from 60 to 180 grammes at a time. The meals are taken at 8 a.m., 12 noon, at 4 p.m., and at 8 p.m. The milk is fresh and pure, and should not be acid in reaction; it is

taken lukewarm. The initial dose of milk is gradually increased, so that at last the patients take 10 to 12 glasses in the 24 hours, equivalent to about four or five pints. No other food is permitted if the cure is strictly observed. In some cases, however, it is allowed to mix a little coffee with the milk. If diarrhœa arises it is taken as a sign that the treatment is not suitable. Constipation is treated by simple water injections. The treatment lasts six weeks, when the patients may be allowed to modify the milk diet, and what is chiefly recommended is raw meat (see note, p. 407) freed from fat and gristle, chopped or pounded and flavoured with salt, which patients will willingly take with bread. There are many slight modifications as to the details of treatment, and it is also advised by some as an adjunct to other forms of diet or combined with climatic treatment. As we have said above, the number of those who are able to subsist upon milk as their sole diet is not large. It becomes most irksome to the majority, and so can scarcely be looked upon as a very practical method.

At the same time it is said that sometimes such a treatment is in the hands of certain continental physicians eminently successful. The substitution of goats' or asses' milk, or even that of sheep for cows' milk is recommended by some.

In connection with this question it should not be forgotten that although milk is said to be a perfect food for infants it does not seem to be so for adults for any length of time, as in order to obtain from it the necessary amount of carbohydrate for the system a very much larger quantity of albumen than is necessary is supplied in the milk which is taken. Thus in order to obtain the amount of nitrogenous material it is necessary to take only three litres of milk, whereas to obtain the proper amount of

carbohydrate at the same time nearly five litres would be required, an amount altogether out of proportion to the digestive powers of a healthy individual, much less of an invalid.

It thus seems that from a dietetic point of view an exclusive milk diet is not to be recommended, although the reports of great improvement of patients suffering from consumption (not in the last stages) appear to be well authenticated. How much this improvement is due to the climatic conditions of the cure and how much to the milk itself it would be impossible to say.

As regards the *Whey Treatment*, or the so-called "Molkenkur" of the Continent, it may be said that an exclusive whey diet is for any length of time practically impossible. In order to supply the body with its sufficient proportion of food-stuffs with whey an enormous amount would be required, as it contains no less than 93·76 per cent. water and only 0·58 per cent. albuminous material, although the proportion of lactose or milk sugar is high, viz., about 5 per cent. Large doses of whey have, indeed, even in the whey cure establishments, been given up, since much gastro-enteric disturbance is produced thereby. As an adjunct to other kinds of dietetic treatment, however, whey appears to have its use. When fresh it is a pleasant, sweet drink. It appears to be of distinct service in relieving cough. It should not be forgotten that butter-milk, although not so palatable as whey, contains a much larger proportion of proteid material, viz., no less than 3 per cent., and as such is of high nutritive value.[1]

[1] Whey is usually prepared from fresh cows' milk by the addition of rennet. If the milk is not quite fresh and warm, it should be slightly heated to the temperature of 40° C. The casein or curd quickly separates and the milk serum may be poured from the solid part.

Of the *Koumiss Cure* proper our information is almost exclusively derived from the Russians, as the locality in which it is pursued is for the most part at any rate in the Steppes of Tartary, although establishments for the cure have been formed elsewhere in Russia. Koumiss is the fermented milk of the Steppe mares, and has been, it appears, the drink of the nomadic tribes of that part of Russia from time immemorial. The peculiar qualities of the milk of these animals are said to be the result of several centuries of selection. Koumiss is of uncertain chemical composition, but the main feature about it is that the milk is exposed to two simultaneous fermentations, viz.,

When fresh it is sweet and pleasant to the taste. The lactose is, however, speedily turned partially or entirely into lactic acid, so that the whey if kept for only a short time becomes much less pleasant and, indeed, less digestible. Buttermilk is the liquid obtained from cream by the removal of the butter in churning. It therefore contains all the constituents of milk except the fat, but inasmuch as the cream for butter making is never altogether fresh, a considerable amount of the milk sugar has been converted into lactic acid. Thus buttermilk is a strongly acid-tasting, rather harsh fluid, almost always very salt from the salt which is added to the cream to keep it. In addition to the above method of obtaining whey given in the text it may be as well to mention one or two other methods. Whey may, however, be obtained from milk by the addition of an acid, whereby the caseinogen is precipitated, carrying with it the fats of the milk. The acid need be very weak. It may also be precipitated by an acid salt or by certain neutral salts. This allows of the preparation of whey by such things as sherry (a wine glass to a pint of boiling milk), which when sweetened is called "white wine whey;" or treacle, two or three teaspoonfuls in a pint of boiling milk, forming "posset;" or tamarinds, a couple of tablespoonfuls to the same quantity of boiling milk (Oi) or alum (1 part to 200), forming what is called serum lactis aluminatum. In each of these cases the whey may or may not be separated from the curd, but if the curd is taken it should be thoroughly broken up. As a rule the whey only is drunk. It is suitable when there is considerable thirst and in summer.

alcoholic and lactic acid. The fermentation goes on in leather bottles or skins, which are smoked out after use, and filled with milk, to which is added sour milk or dried koumiss. The bottles are then kept in a warm place, and frequently shaken. In the course of two to four days the koumiss is ready. When fresh the liquid is sourish and not strongly alcoholic, but the amount both of acid and of alcohol appears to increase on keeping. It is kept in corked bottles in a cool place.

The Koumiss treatment consists of the exhibition of a glass of koumiss every half hour, but other food, consisting of meat and fatty foods, are given at the same time. Other things should be avoided. Naturally this treatment is best pursued in the country, and country air and exercise are said to be parts of the "cure." It is said that patients with phthisis in the majority of cases improve wonderfully under the Koumiss treatment; increase in weight, diminution of fever, loss of cough, as well as increase of general bodily strength, appear to follow. There can be no doubt but that koumiss is a highly nutritious and easily digestible food material, and can be taken when milk and other milk preparations cannot. There is so much to be said against the practice of sending phthisical patients to Russia from this country to undergo this kind of treatment, that for all practical purposes real koumiss cures are not available for us. As a matter of interest, however, a pseudo-koumiss made from cows' milk, and presenting many of the characters of real koumiss, may be obtained in London, and, indeed, elsewhere in England from the Aylesbury Dairy Company. Three strengths are supplied. This pseudo-koumiss has been found of high value in the treatment of phthisis where there is much gastro-enteric disturbance

present. Russian koumiss contains 1 to 2 per cent. of proteid material.[1]

As a general summary of the various milk cures it may be said that in cream, whey, buttermilk and koumiss we have very valuable and nutritious preparations which may be recommended to patients, especially those who are undergoing treatment in the country, where all of the milk preparations may be obtained quite fresh. The exclusive use of any one of them, even if practicable, is not to be advised.[2]

[1] *Aylesbury Dairy Co.'s Koumiss.*—The preparations of koumiss are of four different strengths, "full" containing a maximum of casein; "medium," containing more lactose and less casein; "whey," free from casein; and "diabetic," prepared with or without glycerin as desired. All of these different kinds are sent out in three different conditions—new, not usually sparkling; "sparkling," and "old," according to the three different stages of fermentation which has gone on.

[2] *Of another Milk Preparation.*—Kefir, or kephyr, is a sourish, slightly alcoholic (1 per cent) drink prepared from cows', goats', or sheeps' milk by the inhabitants of the Upper Caucasus. It is quite distinct from koumiss. It is prepared by adding to milk certain so-called "*kefir grains*" which set up in the milk both lactic acid and alcoholic fermentation. The kefir grains are said to consist of the gelatinous and filamentous bacterium (dispora caucasica) with this organism, and mixed in with its stout zoogloea are groups of a certain sprouting fungus and the bacterium of lactic acid. Three processes appear to go on at the same time—the inversion of the milk sugar, the formation of alcohol and carbonic acid, and the formation of lactic acid. The drink is made as follows:—Kefir grains (which may be obtained in this country) are first of all moistened and added to fresh milk (in proportion of 1 to 6), and exposed to the air for twenty-four hours at the room temperature, and frequently shaken. Only a light covering should be placed upon the containing vessel. At the end of that time the milk is poured away from the grains, which may be used again, or dried after washing for future use. The kefir milk is then mixed with a further quantity of fresh milk (1 to 2), and the mixture is put into corked bottles and

The Grape Cure.—The addition to an ordinary nutritive diet of several pounds of grapes daily, is the procedure in the grape cure establishments. The patient is supposed to begin with a comparatively small quantity, *i.e.*, one or two pounds, and to gradually increase it until seven or eight pounds (!) are taken in the twenty-four hours. The first dose is taken before breakfast. Grapes are rich in sugar, but contain but little proteid matter. In fact, if patients are able to consume six pounds of grapes they would only supply themselves with about 18 grammes of proteid or about a sixth of what they require. It follows, therefore, that the exclusive use of grapes and bread for a diet could only be employed for a short time, and the patients would certainly lose flesh with it. It is said that phthisical patients are distinctly improved by the modified grape cure. A couple of pounds of grapes a day not only supply a considerable quantity of grape sugar capable of easy absorption, but also improve the cough and allow of free expectoration, with an improvement in the breathing. If, however, the patients lose weight, or should digestive troubles appear, the treatment should be abandoned.

It is certainly a fact that grapes appear to be particularly liked by phthisical patients, and hence, unless there is a distinct indication to the contrary, a moderate allowance of them may be added to the patient's dietary, and when the patient happens to be in a place where grapes are abundant, as in so many of the health

frequently shaken. At the end of one to two days the kefir is ready and is taken effervescing.

The drink is highly nutritious, containing 3·8 per cent. of proteid, 2 per cent. of fat, 2 per cent. of lactose, 0·9 per cent. of lactic acid, and 0·8 per cent. of alcohol. It is indicated in the cases when koumiss is employed, but is stronger in proteid.

resorts on the Continent during the autumn, the indulgence in this fruit may be freely allowed.

Of the Method of so-called Forced Feeding.—This method has been incidentally mentioned elsewhere in this book and needs only a passing reference. It was suggested by Debove ("Du Traitement de la Phthisie Pulmonaire par l'Alimentation Forcée," Union Medic., 1881), upon this plea, that many patients suffering from chronic phthisis do not take, of themselves, sufficient nutriment because they have no appetite, and, indeed, have a positive repugnance to food. In many of such cases the author supposed that there is little or no impairment of digestion. This led to the trial of the so-called forced feeding by introducing the food directly into the stomach. In certain cases in which this plan was adopted the patients were found to be quite able to tolerate the food. The stomach was first of all washed out with the stomach pump and then a litre of milk, and on the two following days two litres, 200 grammes "scraped meat," and ten eggs were introduced. In the cases reported much improvement was said to have followed. It is, of course, a method which cannot be often used, even if advisable, which is a matter of doubt. It should certainly be remembered, however, that the plan of washing out the stomach in obstinate cases of dyspepsia is a method that might be effective in relieving that condition, as it is sometimes so markedly successful in chronic gastric catarrh. But even washing out the stomach is a plan which could only be done in occasional cases of phthisis.

CHAPTER XII.

CLIMATIC TREATMENT.

(*a.*) **Considerations as concerning the Patient.**—It is an almost universally received axiom, especially among the wealthier classes in this country, that a person with consumption should if possible "go abroad" for the cold months of the year. It is no doubt because of this general belief in the prophylactic value of climate as a method of treatment that so many unsuitable cases are sent, or go without having been sent, to winter away from home. Hence it happens—only too often—that bitter disappointment is felt by the patient and his friends when spring and summer return and find him no better, but rather the worse, and he returns with a fixed idea that if he had remained at home all through the winter he would not have been nearly so ill. An excellent method of treatment thus has aspersions unjustly cast upon it, because it has not been reasonably and sensibly applied. The cause of its want of success is as a rule to be attributed to one of two causes, either because the case was unsuitable for climatic treatment at all, or because it was unsuitable for the exact kind of climate chosen. Sometimes it is true that there is a third possibility, viz., that some particular or unforeseen combination of circumstances, such as exceptionally bad weather or what not, may unfavourably affect what would otherwise have been a plan of treatment attended with much benefit. For the two first mentioned causes of non-

success either the patient or his adviser is to be blamed, but for the third possible cause it is obvious that no provision could have been made.

From what we have said and implied in former chapters it will have been gathered that too much importance cannot be paid to the two main considerations, namely the choice of suitable cases and the choice of suitable climates, if we are to obtain from climatic treatment all that may be reasonably hoped from it. Our endeavour must be in every case to weigh well all the circumstances connected with it, and not to advise a change of climate unless these be favourable both from a medical and from a common-sense point of view. We have then to ask ourselves this fundamental question in every instance, Is any real good likely to follow from a trial of different climatic conditions? Unless we can satisfy ourselves that such a question may be answered by a decided affirmative, it is always best to give a decided negative, and in cases upon the border line, in which the good is problematical, the alternative of staying at home should have the benefit of the doubt. This alternative is particularly important in the case of the middle class patient of limited means and is a vital question to the poorer classes. We may in a given case be able to say, from a consideration of the condition of the lung, of the general health, and from a knowledge of the symptoms which are present, that a winter residence in some suitable climate away from home would be beneficial. We are, however, met with the pregnant inquiry—will the patient be sure to be worse if he remains in England, under improved conditions of life? The experience of out-patient practice at a chest hospital, such as Victoria Park, here comes in, and is exceedingly valuable. We are able to recall many cases of incipient

phthisis, seen in the autumn, which have been enabled to pass through the rigours of an English winter in a perfectly satisfactory manner, and without any marked increase in their disease, by simply taking the precautions against ordinary risks which we have been able to suggest. This experience among the poorer classes is by no means unconfirmed by that of others, but we must recollect that it is also abundantly proved by observation that the classes from which hospital practice is mainly derived are able to present a far greater resistant power to the progress of phthisis as it is ordinarily met with, than are the classes above them in the social scale. The cause of this greater power of resistance is probably connected with the more exposed and hardy life patients in such a condition are compelled to live. Foreign residence, that is to say mere residence for the sake of health, is practically impossible for the poorer classes, but even among such patients, two possible ways exist in which they may attempt to better the climatic conditions of their lives. The first is by taking a sea voyage in the position of steward or stewardess on board ship, or in some other possible capacity by means of which not only a free passage may be obtained, but also some wages for the work done may be received. The second is the chance which sometimes occurs for the patient to leave this country for a more favourable climate, where he is able to resume his occupation under more promising conditions. If we are asked to advise under one or other of these circumstances, a decision must be very carefully given. Life on board ship under the conditions indicated is not likely to be an easy one, and in some instances it is certain that the remedy would tend to increase rather than to cure the disease. The kind of ship, the nature, direction and

duration of the voyage in relation to the season of the year, have all to be thought of. We have no hesitation in saying that in our experience a sea voyage for the phthisical, except under very favourable conditions, often does harm and rarely does permanent good. We may give an instance of what we consider unsuitable conditions. A short time ago a patient with quiescent phthisis of one apex came to report himself to us at the out-patient department. He said that he had been recommended to go for a "sea voyage," and had entered into an engagement to go as a steward in a steamboat. He had had no previous experience of the sea. On inquiry it was found that he had bound himself, by signing an agreement, to serve almost exclusively in the North Sea during the winter months—perhaps the most unsuitable climate for the time of year he could have chosen. Argument was useless—he was quite satisfied that if he "went for a sea voyage" he would be doing the right thing. With respect to the second alternative, when our advice is asked, as it often is asked, whether it would be a good thing to attempt to get to some such place as Cape Town, Adelaide, Wellington, or the like, to accept a chance opening which has occurred, great caution is equally necessary in advising the patient, as a hasty and ill-considered opinion may lead to a great deal of misery to the patient as well as to those who are dependent upon him. Nevertheless patients start from home every year to go to Australia, without the vaguest notion of the kind of life that is awaiting them on their arrival, and many of them are forced to realize too late that their lot is cast in such a town as Melbourne, the climatic conditions of which are the same or even worse than those of the home they have left.

As we go higher in the social scale, and among the

monied classes, the question of expense becomes of less importance, and climatic treatment becomes more possible, as indeed it is more required. The more accustomed people are to varying degrees of luxury, the more do they feel the effects of anything which approaches to hardship, and the usual conditions of the English winter and spring are to many, particularly when invalided, a very decided hardship. It thus comes about that in giving advice in such cases it is almost routine practice to suggest wintering abroad, and it is given even in cases of doubt. There is, however, a class of patients who are quite as susceptible as the wealthy to the exasperating vagaries of the English climate, but whose means are insufficient to allow them to indulge in prolonged absence from home and from work; these comprise the professional classes, and many comparatively young men who are attacked by the disease when on the high road to considerable prosperity, such for example as young partners in good businesses, head clerks and the like. Such men have good incomes, but the incomes are being hardly earned, and practically cease if their work ceases. These persons are the most difficult to deal with. We are confronted by the horns of a perplexing dilemma; they must either leave their businesses and so lose their incomes, or they must keep their incomes and become worse and worse as regards their disease. In some cases it is best to temporize—to suggest residence away from town for considerable periods at such southern health resorts as Hastings, Ventnor, Bournemouth, or the like. This is to be preferred to advising an attempt to reside at a foreign health resort, where home-sickness, supposing the patient is unaccompanied by his family, added to the sensation of banishment, coupled with the necessity for a rigid economy, will in many cases effectually interfere with

the good which might otherwise ensue from the improvement of the climate. A great exception to this rule must of course be made when a patient of limited means is fortunate enough to have friends who will entertain him in some place where the climate is considered to be of use in the treatment of his complaint.

Accurate information may nowadays be easily obtained with respect to all foreign health resorts by any one who has the time and inclination to consult the literature of the subject. Very many books have been written, from which may be obtained more or less complete accounts of life at any one of the health resorts in any part of the world. A short list of some of the most useful of these is appended. The natural features and climatic conditions of most inhabited parts of the globe are made familiar to us by means of photographs and by the weather reports in the daily papers. An accurate knowledge of climates is not, however, by any means all that we require in any given case. We have to be well acquainted with the general condition of the patient, and with the onset, course, and extent of his disease. We need to know even more about the patient than about the climate, although it is true that no conscientious medical adviser will prescribe any particular place or climate without either having personal experience of it or without having made himself fully acquainted with its climatic and social conditions.

We will now turn to the particular classes of phthisical patients who may be expected to benefit by climatic treatment, and those classes who are unfit for it.

First of all we may lay it down as a practically unalterable law that cases of advanced and active tubercular disease should not be subjected to distant removal from home.

In cases in which the disease is active, even although

the lesion is not extensive, it is unwise to recommend a change of locality, at any rate of any great extent. Climatic treatment, on the other hand, is of service, and often of great service, in cases of early or incipient phthisis, unless there is much fever, which, as we have seen, is not often the case. It is also indicated in cases in which the disease is either quiescent or chronic, provided that the lungs are not too extensively diseased, and provided also that there are no very marked symptoms remaining or producing distress. If a patient is fairly free from cough, dyspnœa, and fever, and can take a moderate amount of exercise, other conditions being favourable, symptoms of dyspepsia, anæmia, and even occasional night sweating need not contra-indicate removal to a more suitable climate. Indeed, we may very reasonably hope that under more favourable conditions of life he may throw off these latter symptoms and make real improvement, even although the physical signs in his chest are marked and indicate extensive areas of disease. Thus for example it is not reasonable to say that a patient with vomicæ in his lungs is not *per se* a fit subject for the climatic method of treatment. As we have pointed out repeatedly in the preceding pages, the mere presence of the physical signs of vomicæ in the lung is not sufficient to indicate that the disease is either very advanced or hopeless. On the contrary, the signs of vomicæ may be almost disregarded, if at the same time we have proof from the absence of fever, much cough and expectoration, and wasting, that the tubercular disease is not in a condition of activity.

If the reader has followed our argument with regard to the causation of susceptibility, he will understand that we do not regard heredity as such a fatal predisposition that it is useless to try and counteract it. Thus it is an indi-

cation rather than otherwise to suggest the best conditions of climatic treatment, other things, of course, being favourable.

The contemporaneous presence of some other disease or its former existence must be very carefully weighed before a decision as to removal from home is concluded. This is particularly the case when some other disease of the lung itself is or has been present besides the tubercular, such for instance as emphysema or bronchitis, or of past pleurisy or bronchitis. The presence of bronchitis or the tendency to bronchial catarrh makes, however, some difference as to the locality to which the patient, if otherwise fit, should be sent. To this question, however, we shall return presently.

Disease of other organs, and especially any morbid condition of the heart or kidneys, must be carefully considered in the selection of places of residence, but as a rule they, too, do not interfere with the main question, provided of course the patient is considered to be otherwise fit.

In cases in which the tubercular disease of the lungs has been present for a long time, we are greatly aided in recommending or refusing to recommend climatic treatment by a knowledge of the success or failure of previous treatment at home. In many conditions of the tubercular disease in an early stage, there is to be noted a certain irregular periodicity in the onward course of the disease. At times, as has been before pointed out, it makes rapid progress, but a period of slow progress or of quiescence follows. It would be obviously unwise to send the patient away whilst the disease is active, but it is the very time to do so during the period of quiescence. It should be added that cases in which hæmoptysis has been a prominent feature from the beginning are not those very

suitable for sending abroad, and no case should be so treated unless a considerable interval has elapsed since the last attack.

Assuming, then, that the physical condition of the patient is considered suitable for change of climate, there are certain other minor points, not directly medical, which come in. As these, no doubt, influence to a marked degree the result at which we are aiming, they must not be neglected.

Let us, then, mention one or two of them. The first is the question whether the patient is, from previous experience or natural temperament, suited for a prolonged existence amongst foreign surroundings. To some people the transition to foreign manners and customs, foreign food, and a foreign tongue, comes as a pleasant variety after years of the monotony of home life; but to many others—and these very possibly the majority of people—all such considerations constitute a continual worry and annoyance, which before long may culminate in a feeling of home-sickness, which materially diminishes the good which the improved climate and surroundings should effect. Then, again, it may so happen that a patient finds the place to which he has been sent disagreeable, whilst at another he feels more at home. For example, a consumptive patient who was utterly miserable at Davos longed for St. Moritz for some reason or another, and consequently, when sent there, was in a happier frame of mind, and so in a better condition towards recovery. Again, a knowledge of the language makes a considerable difference to a patient's comfort, and some knowing French hate places at which German is the chief language spoken, and the reverse. As with the language, so with the modes of life and the style of cooking. The latter consideration is of the greatest importance to some,

especially middle-aged people. If a patient can only be happy with French surroundings he should not be sent to Germany, nor should anyone without a knowledge of French or Italian be sent to such places as Ajaccio or Palermo, no matter how suitable they may be from a climatological point of view.

We may mention, too, the importance of patients being prepared for, and well informed as to, the routes, length of journey, means of transit, and all other points in connection with the place selected by the medical man.

Patients not unfrequently leave England for some continental or other health resort in the autumn season, and for want of definite and detailed practical advice, run risks which might well have been avoided, and which possibly set up additional mischief in the lungs, which may keep them in bed for weeks or even months. Weeks in bed had better by far be spent at home. In like manner much harm is likely to follow an ill-considered return to England from foreign health resorts. The journey home is only too apt to be "rushed" without the least regard to the dictates of prudence; the convalescent feels himself so much better that the temptation to hurry home quickly to tell his friends of his improved health is too much for him, and he travels night and day, only to arrive home with a "fresh cold" caught on some unnecessary exposure, and for which either his own folly or the carelessness of his doctor is answerable. Then, again, not only the arrangement of the journey and the length of time it should occupy, as well as the places *en route* at which he should remain both going and coming, but also the time of year he should quit one place for another, must be duly notified by the medical adviser. One of the ways in which "home-sickness" is apt to show itself, even in its mildest form, is this intense desire to rush

straight home as soon as the spring months begin. At the southern health resorts the beginning of spring is indicated by a profusion of flowers and by soft and balmy winds and sunshine as warm as that of June or July in England. The consumptive patient is very apt to forget that the same kindly winds, the same bright and warm sunshine, and the same flowers are not then to be found if he return to his own country. The old poetic fictions with regard to the "merrie month of Maye" are almost realized in the sunny south, but in our country the prosaic fact remains that the month is chiefly to be remembered by its biting and cruel east wind! This is enough to warn the consumptive who has wintered abroad that he must not think of returning to England until June, and not then unless he hears that the weather is fair. One means by which it is possible to diminish the home-sickness of which we have spoken, is to be found in the selection of fitting companionship and occupation for patients of both sexes. The aspect of young people below thirty years of age, banished for the sake of their health and entirely alone as far as congenial companionship is concerned, forms one of the most unsatisfactory sights to be seen in a foreign health resort. The young man is too often driven to seek occupation in the billiard room, and she of the opposite sex endeavours to find distraction in too abundant reading and writing in solitude. Of these, perhaps, the latter leads the more healthy life, since she is at any rate more inclined to seek the open air, but the sensation of home-sickness is constantly present to both. The old saying, that "when in Rome we should do as the Romans do," often leads the consumptive patient in a foreign place to adopt native manners and customs and the companionship of the natives of his own rank of life *or below it*, and to shun

association with his own compatriots. In some cases this determination works well, but it should not be encouraged for many and obvious reasons.

The natural temperament of the phthisical patient has always to be carefully considered, and no general advice is of much use without a due regard to the previous habits and tastes of the individual. Two broad types of phthisical patient may be recognized—the anæmic and dull, heavy, and more or less despondent type, and the sanguine, lively, and hopeful. Of the two, the latter is the more common. Each of these types naturally requires separate consideration from the point of view of climatic treatment, as it is obvious that the same surroundings will not suit both. As a broad rule, it is better to place patients of each class in circumstances nearest in accord with their different tastes, than to seek to introduce them to new or unaccustomed and very probably distasteful conditions. Thus, the patient of either sex whose life previous to his or her attack of illness has been passed in a whirl of excitement and amusement, should rather, if there is any choice allowed, be sent to a moderately fashionable and lively health resort than to a dull and sleepy one; whilst, on the other hand, the patient whose chief pleasure of life has been derived from outdoor sports or other amusements, should not be advised, still supposing a choice possible, to seek health at a place where none of his fancies may be indulged. This view, we should mention, is not that which is very commonly held. Some authorities insist that change of residence should be accompanied by change of habits and pursuits, and believe that the quiet and retiring nature of the one may be improved by being "drawn out" into a round of public gaiety, whilst the bustling, excitable character of another is benefited by a period of enforced dulness.

We have no hesitation in dissenting from this view. Each class should be advised, so that the surroundings are as congenial to former habits as is compatible with the real object of the treatment, viz., that as many hours as possible should be spent out of doors, and that the increased possibilities of sunshine, light, and purer air should be enjoyed to the uttermost. A word of caution, however, is necessary with reference to those patients who are either convalescent or not very much affected with the disease, viz., that there shall be no excess either of in or outdoor amusements, particularly the former. We have already condemned the habit, so much indulged in, of the evening dance. Very few, if any, patients are in the condition to indulge in this amusement with impunity, and early hours must be invariably observed.

(*b.*) **Considerations as Concerning the Locality.**—Just as we have asserted that there is no specific drug which cures consumption, so are we compelled to insist that there is no specific climate which does so. It is true, however, that change of climate, carefully selected in suitable cases, more often than any other method of treatment improves patients suffering from pulmonary tuberculosis, even if it does not actually cure the disease. We lay stress upon the two provisos, viz., suitable cases and suitable changes of climate. As regards the former, we have indicated shortly in the last chapter what we consider suitable and what we consider unsuitable cases to be subjected to climatic treatment. We have now to indicate the varieties of climate which are to be obtained in different parts of the world, and the cases which have been found to derive most benefit from each. Naturally we shall be able to give most of our attention to those which may be obtained at a comparatively short distance from home.

It would be impossible in a work of this kind to go at any great length into the question of climate, or into the question of the minor varieties of climate which distinguish one place climatologically from another. Many excellent books have been written upon both of these questions, and the subject is by no means exhausted. We must limit ourselves to very rough generalizations, which are, after all, sufficient for the purpose of indicating the different districts in which a climate suitable for a particular class of case may be obtained. We are aware of the fallacy which attaches to such generalizations. A whole district is spoken of as though the climate throughout was the same, whereas it often happens that considerable differences as regard their climate exist even in places quite close together. Thus "Climate" is known to depend upon various factors, such as height above the sea level, moisture of the atmosphere (relative humidity), the amount of rain, the amount of sunshine and prevailing winds, to say nothing as to the important question of soil. It is evident that many of these factors may be found to differ in places located almost side by side. A simple example of what we mean may be given. It is often said that the coast of Devonshire, Dorset, and Hampshire is warm and "relaxing." This is very probably quite true of some individual places upon those coasts, but it is quite untrue of others. It may be true of low-lying places situated in land-locked bays, but is evidently not correct with respect to places, perhaps comparatively near, situated high up upon the cliff unprotected from winds, and otherwise differing altogether from the first-mentioned places. In fact, it is a boast of certain places upon these coasts that within a few miles you are able to get suitable winter and summer climates.

With such reservations, then, it is possible for us to

make use of the ordinary more or less rough classifications of climates which are current, and to leave the more minute and correct details of the different varieties to be obtained in a given district to the local medical authorities.

First, then, of the so-called *ocean climate.*

The climate of the ocean, such as may be obtained by a sea voyage, is no doubt that in which the purest atmosphere is to be obtained as regards freedom from organic and inorganic particles, and from gases which must not be considered anything but abnormal additions to the ordinary composition, viz., carbonic dioxide, and the like. It is, however, always heavily charged with moisture, as might be expected from the evaporation which is constantly going on from its surface. It is also equable, *i.e.*, the range of temperature in any given twenty-four hours is not great. In southern latitudes—and it is in southern latitudes only in which it is advisable for phthisical patients to travel—the sun heat is often very great during the day, and is followed by a rapid cooling down of the air, which leads to condensation of moisture upon all parts of the ship, but this evening fall of temperature is far less felt at sea than it is on shore, and is less dangerous to invalids. Besides this amount of watery vapour, the ocean air is said to be charged with ozone, iodine, bromine, and other substances which are volatilized from the sea water, of the influence of which upon the human body in health and disease we are unable to say much. For the most part the ocean climate is bracing, and conduces to appetite and sleep, but the chief drawback to a long voyage is the want of prolonged exercise. In the old days, when provisions were apt to run short, and economy had to be rigidly practised, this want of exercise was of less importance than it is now, when travellers are provided with three large meals every day, and almost all

the luxuries of a first-class hotel. To some people, and especially such as have been occupied with harassing affairs at home, the enforced idleness on board ship must come as a welcome relief. The absence of letters and telegrams alone is to the man of business a novel sensation, and to anyone who stands in need of perfect mental and bodily rest the ocean voyage affords the best approach to such a condition. The question of sea-sickness has, of course, to be thought of, and in some cases would be an absolute bar to a sea voyage. It is, however, a fact which has been frequently noticed that persons with phthisis who suffer much from feelings of nausea and reflex vomiting on shore are often improved after the first short bout of sea-sickness at sea, and may afterwards fare better in this respect than their non-phthisical fellow-passengers. The voyages most suitable for the treatment of phthisis are those to Australia and New Zealand, to South America, and to the Cape. It would be impossible for us to give a detailed account of the different lines of steamers and sailing vessels which are available for those who wish to attempt the sea as a cure for their complaints, but such information can at all times be obtained by reference to the numerous advertisements in the London daily papers. The circumstances for and against any particular route, and for and against any particular line of ships, or even for or against any particular ship, have to be taken into careful account by the medical adviser who has suggested the ocean voyage.

A word of caution is here very necessary. The sailing voyage to Australia or New Zealand must only be advised after very careful investigation of the circumstances under which the ship sails. It is to be feared that patients and doctors alike are too often tempted by the highly-coloured accounts which appear in the advertisements as

to the special comforts and advantages that are offered to consumptive passengers by some of the less scrupulous agents of lines of sailing ships. The use of steam has so largely superseded the older method of sailing that sailing vessels are no longer the "Argosies" that they were, and as the receipts of each voyage have diminished, so also have the accommodation and other arrangements for the general comfort of the passengers. This becomes, therefore, a very serious consideration for the consumptive passenger, who, above all others, is dependent upon good and sufficient food, and many small comforts which the healthy traveller can do without.

The precautions to be observed by each patient, and the line of conduct, of diet, and other important details, have also to be laid down by the medical man as far as possible. The time of the year in which to undertake such voyages is of much moment, the object which has to be borne in mind being to enable the patient to arrive at his port of debarkation during the summer season. Starting in the month of October and returning at the beginning of April, a patient may pass fifteen months in almost continuous summer, and three months or longer, which he will have time to spend in Australia or the Cape, may always be passed in the country districts and away from towns. Shorter voyages may be made to the Canary Islands, or to Madeira, or along the coast of the Mediterranean. The voyage to India, although in many respects a most suitable one for some kinds of invalids, is apt to be too trying for phthisical patients except for such as are of the phlegmatic temperament, and are not as a rule upset by excessive heat.

The kind of case which is suitable for attempting the ocean voyage includes the patients who are in an early condition of tubercular disease, particularly in the young,

those in whom there is much nervous excitability and inability to sleep, or in whom there have been repeated small hæmorrhages with or without the physical signs of commencing disease. Cases of phthisis in which there is a limited lesion at one apex, but no evidence of activity about the disease, and a liability to bronchial catarrh, are especially improved. Again in certain cases it is well to advise a sea voyage for those patients to whom we have previously alluded, viz., those who are in business and who have been much harassed with the high pressure incidental thereto. Such men, even if not actively phthisical, are in a condition of susceptibility, and mental and bodily rest is essential to their recovery. In the same way the ocean climate is of great service to hard-worked women such as governesses, nurses, and others in whom signs of phthisis have been made out, particularly in the decade between thirty and forty. Quiescent conditions of phthisis, even if advanced, may occasionally benefit by this change of surroundings, as may also those patients with very chronic disease in whom one lung has practically been rendered useless for breathing purposes, rendering them very short of breath and liable to attacks of bronchial catarrh. The absence of the mechanical and chemical, not to say bacteriological irritants in the air conduces to the recovery of the catarrh, while the continued abstention from any exertion which lays stress upon the breathing capacity, enables the respiratory functions to be better carried out by the lung tissue which remains in a working condition.

The climate of islands resembles that of the ocean in many respects, and particularly as regards the equability of the temperature, or freedom from great and sudden changes. The prevalence of steady winds may in some of them be looked upon as a constant feature of their

climate. Islands vary considerably according to their geographical situation, and hence cannot be classed together in the same way as the various ocean voyages. The island of Madeira has long been celebrated as a health resort for consumptives, and the principal Canary Islands have of late years attracted much attention in that capacity. Madeira, like many other island resorts, derives its popularity from the position of its chief town, Funchal. This latter is built on a hillside sloping down to the bay, and is protected from the prevalent winds, and is singularly free from dust. Residence can thus be selected at almost any level from the sea, and a considerable number of villas and hotels are available for the purpose. The climate is of the subtropical variety, and the rainy days are for the most part characterized by heavy showers, followed by bright sunshine. Accounts have differed strangely as to the amount of relative moisture in the air of Funchal, but the place must be classed as a whole as somewhat relaxing to persons of vigorous constitution, although admirably suited for those for whom the air of a bracing place is, to use a common expression, "too strong." We should not advise Madeira as likely to be suitable for young patients with phthisis, or yet for early cases of the disease. It is best suited for persons who have passed the age of thirty, and in whom the disease has shown the inflammatory type, that is to say in whom there has been evidence of large and rapid consolidation followed by partial clearing up of the lesion towards its downward and outward limits.

The climate of other parts of the island is much more variable, and is often cold and stormy. The scenery of Madeira is exceptionally fine, but can only be seen by travelling on foot, or on horseback, or, as is the usual method in the island, in hammocks carried by relays of

bearers. The language of Funchal is of course Portuguese. There is ample accommodation for invalids, indeed, the chief drawback to a residence there is the large proportion of invalids in the population, of various nationalities, the German at present predominating.

The climate of the Canary Islands as a group is hotter and drier than that of Madeira, and hence less equable, and all the islands are more subject to heavy tropical rains, although the actual number of rainy days is small. In one year, for example, there were only forty rainy days recorded at Orotava in Teneriffe.

We may mention in passing the importance of noticing the number of rainy days, and not the amount of rain only, when considering the climate of a place. The former consideration is of more import than the latter from the invalid's point of view. At some of the places throughout the world justly celebrated for the excellence of their climate the absolute amount of rainfall may appear great, but the number of rainy days is few. This is due to the fact of the heavy rain storms which are generally experienced more or less in all subtropical regions. Such storms tend to send up the amount of fall recorded, and one such storm will very likely account for as much rain as would come down in weeks of "drizzle" to which we are so often subject in this country.

The large number of rainy days at some of our own south country places of winter residence forms one of the greatest objections to their usefulness for phthisical patients, although the absolute rainfall will compare favourably with those of many of the southern health resorts.

The rush of persons in search of health to the Canary Islands has been of late years very considerable, and for a time the accommodation for them did not keep pace

with the demand, but latterly successful efforts have been made to obviate this difficulty. At Santa Cruz and Orotava in Teneriffe, and at Las Palmas in Grand Canary, there is now, we believe, sufficient and comfortable residential accommodation. No doubt there is that drawback to the Canary Islands which has been somewhat accentuated, viz., want of any sufficient occupation for a long stay. There is, too, but little in the way of fine scenery, except about Oratava and the Peak, and in the smaller island of Palma. There is little or no fishing or shooting to be had, and the ordinary amusements of an English outdoor life are only slowly becoming acclimatized. The language of the Canaries is Spanish.

As regards the value of the climate as a treatment for phthisis, we have not so much data as in the case of the Island of Madeira, as its use for the purpose has not been so long established. It seems to be of service in the chronic forms of phthisis, but cannot compare with other places for the treatment of the early stages of the disease, particularly where there is any tendency to hæmorrhage or to periodic activity. Many of the cases of chronic phthisis, in which there is in addition a considerable amount of bronchial catarrh, have been improved, and in many instances great benefit has resulted from an occasional change with Madeira. The Canary Islands are said to be among the healthiest places in the world. There is, however, but little doubt that the summer heat is too great for the majority of phthisical persons, but when it can be borne there is no reason why the patient should not permanently reside there.

Very similar to the climate of the Canaries and Madeira is that of Algiers, but it differs in this respect, that it is not so constant in its character as that of the

islands, and is sometimes distinctly cold and wet. Taken as a whole, however, the climate has the opposite qualities, being hot and dry, although with a considerable number of rainy days in an average season. The rain, however, is very heavy at times, although the ground very soon dries after the showers are over. The temperature is apt to fall suddenly at sundown, but the nights are mild and balmy. The town of Algiers itself is divided into a French town and a native town, the former being nearest the sea, but in both the sanitary arrangements are very defective, and English visitors are to be advised to proceed to the suburbs, particularly in the district of Moustapha, where there is a good residential hotel, situated upon rising ground to the southwest. An old Roman Bath, known as Hammam R'Ihra, about 60 miles from Algiers and lying nearly 2,000 feet above the sea, is now coming into much favour as a health resort, and affords good accommodation and some amount of sporting. Both there and at Algiers it is very necessary that patients should observe strict attention to the rules of hygiene, both with respect to residence, habits, and food.

Biskra, in the interior of Algeria, possesses many climatic attractions for patients with limited or early lesions. It is reached by railway from Philippeville, to which place steamers are despatched from Marseilles every week. There is a first-rate hotel at Biskra.

Of other health resorts similar to those which have been just described, we may mention Ajaccio in Corsica, at the head of a beautiful bay, well protected from the north, and admirably suited to wealthy persons with moderate or quiescent disease of the lungs, to whom the sport of the island may be an attraction. This place, however, is not suitable for anyone who will have to lead

a real invalid's life, as there are at present few of the minor comforts to be obtained upon which success depends.

Palermo, in Sicily, although one of the most beautiful of all the Mediterranean health resorts, is not without drawbacks, being sometimes rainy and subject to various winds, the sirocco being an occasional visitor during the spring months. Accommodation is exceedingly good in the town, both for invalids and travellers. Contrary to what one would have expected, it would appear that the climate of Palermo is more suited for the excitable type of phthisical patient, and that the more phlegmatic natures do not derive much benefit from it. Corfu possesses a less equable climate than most of the islands. It is not suitable during the early winter months, but during February and March it is very well adapted to many cases of chronic phthisis. The town is very windy and dusty, but the great attractions of the place are the yachting facilities, which render it preferable as a health resort to many Englishmen with whom yachting is a passion. At Corfu, as in Corsica, there is but little preparation made for the reception of invalids. The ordinary route thither is by steamer from Brindisi.

We next come to the question of the *climate of the sea coast.* This may be roughly classified into two divisions, viz., the one being stimulant and bracing, and the other sedative, soothing or, as it is called, "relaxing." The eastern and western shores of our own country supply us with the best examples of these distinctions. The climate of the east coasts of England and Scotland is for the most part bracing and stimulant, whereas in the west and south we have to do chiefly with warm and less bracing varieties. The amount of rainfall and the relative number of rainy days is much greater on the western than on the eastern

shores. According to the careful and elaborate records which are nowadays kept of the temperature and other details of the weather in all parts of the world, and particularly in this country, we are able to draw some useful lessons on the climate of the health resorts at different seasons of the year. For example, in January it has been shown that the *isothermal lines*, *i.e.*, the lines joining the places with the same average temperatures (Humboldt), have to be drawn more or less vertically from west to east, the place of the highest average being that most to the west, viz., Land's End. Next comes the second isothermal passing through Truro (44 degrees), next one passing through Pembroke in Wales, and between Truro in Cornwall and Plymouth in Devonshire; a fourth isothermal passes through Beaumaris, almost vertically downwards to Sidmouth, and so on. Thus we have places to the north with the same average temperature during January as places much farther to the south, the average temperature of the Isle of Wight being 41 degrees, whilst that of Land's End is 45 degrees, and that of Lincoln 38 degrees, being situated most to the east. This somewhat unexpected fact is explained by the westward direction of the warm, moist winds from the Atlantic. These winds from the sea, of course, first of all strike the western counties, but as they pass over the chilled earth which lies between the west and eastern coasts, their warmth is dissipated, and the farther from the western shores the lower is the temperature. We must also remember, however, that these winds are charged with moisture, and so when they meet with the western hills are the cause of the rain which is so prevalent in such districts.

The April isothermals are drawn, however, almost at right angles to the January lines, but with a direction

from north to south. The west is for places of the same latitude somewhat warmer than the east, but not so much difference is noticed. The sun having been shining upon the land warms it, and the sea is now but little higher in temperature than the land. Still, the most south-west part of the country is the warmest. In July the isothermals are drawn in a direction cutting those of January almost at right angles; the east and west are but little different in temperature, but the lines are drawn from west to east with a northward inclination; thus those places having an average temperature of 61 degrees are the Lizard in Cornwall, East Retford to the north-east, and near Norwich to the east. Leicester is warmer than the Isle of Wight, and about London is the highest average, viz., of 64 degrees. These very interesting facts are explained by remembering that the land which takes up the heat of the sun more easily than the water is at its hottest; and there are at all places near the coast cooler winds blowing which have a tendency to depress the temperature of sea coast places, whereas the places in the middle of the land away from the sea are free from cooling breezes, and have a relatively higher temperature. In the autumn the sea is warmer than the land, and places upon the sea of the same latitude are of much the same average temperature; but the isothermals have a southern dip as the land away from the sea is cooled by the autumnal mist and winds. Cornwall is the warmest autumn county as it is washed upon both sides by the warm western sea.

Speaking, then, from the point of view of the invalid, the western, and particularly the south-western seaside places, are best for both autumn and winter, and as the middle of winter is reached, the more west the better. Obviously the east coast is too cold for phthisical patients, and even in the west and south-west we have to consider

the great drawback of the heavy rainfall and the high humidity. The excessive number of rainy days at those southern health resorts is, as we have said, their great drawback. If possible we should endeavour to obtain a more favourable example of sea-coast climate in winter for our phthisical invalids where there is a greater chance of dry and sunshiny days. If for some reason or other a patient cannot or will not leave this country we may send them to such places as Penzance, Torquay, Sidmouth, Lyme Regis, Poole, Bournemouth, the coast of Hampshire, or the southern part of the Isle of Wight, or further north to Tenby or Ilfracombe, or to Aberystwith, Barmouth or Llandudno, in North Wales. We are obliged to confess it, that however these places surpass in climate the eastern or midland or northern places, they almost all suffer from one serious fault, that there is so little means of amusement for the invalids, and indeed hardly anything is done to merit the title of winter health resort in its technical sense.

The shores of the Mediterranean, particularly those of the south of France and the north of Italy, are much to be preferred to any places upon our own coast for phthisical people during the winter and spring. There is scarcely any part of the continent so familiar to us all by actual observation or by repute as the district known as the Riviera, and nearly every considerable place upon this delightful coast has been and is recommended as winter and spring quarters for consumptive invalids. In these, as in all other districts, there are local peculiarities which must be taken into consideration. Those places which are most resorted to by the English about this coast are Hyères and its suburb towards the sea, Costebelle, Cannes, Nice, and Mentone. Perhaps of

all, that which is most recommended to the phthisical is Mentone, which was brought into repute by the late Dr. Henry Bennet. Of the Italian portion of this coast San Remo is that which is the best known, but there are other smaller places both in the French and in the Italian Riviera which are coming into repute. Of these may be mentioned St. Raphael between Hyères and Cannes, Alassio beyond San Remo, and Albenga near to it, and round the coast close to Genoa, Pegli.

In advising patients to pass the winter at one or other of these places we may be chiefly guided by the particular habits and peculiarities of the individual, always supposing his case to be such as we consider likely to be benefited by a stay away from this country at all. In all of these places there are one or more English physicians in practice to whom patients should be recommended to apply for advice as to the best position for residing during their stay, etc.

Nearly every variety of case, at any rate all those in which the disease is capable of improvement or arrest, do better on the Riviera than they are at all likely to do at home, and this is perhaps all that one can definitely state as regards prognosis. It must, however, be remembered that the climate of the south of France is uncertain, and varies much from year to year, and it is at times moreover exceedingly deceptive. Brilliant sunshine and a cloudless sky in the forenoon will sometimes tempt patients to discard precautionary measures, unmindful of the keen searching wind to which they will be exposed a few hours later; and it not unfrequently happens that carelessness leads to disastrous results. To any patient going to the Riviera for the first time two pieces of advice should be given—the first is not to expect too

much of the climate; and the second is, be guided as to habits and mode of life entirely by the advice of one or other of the resident physicians.

We next in order come to the *climate of the High Altitudes.* The localities in Europe where the treatment of the consumptive patient at high altitudes has chiefly been carried on are all, or almost all, situated in the same district, viz., in the Canton of the Grisons in Switzerland. Davos and St. Moritz are the most frequented of the towns or villages at which accommodation for the invalid is to be obtained. They each are situated 5,000 or 6,000 feet above sea level. The main characteristics of each are much the same. The atmosphere is much rarefied, and presents less resistance to the penetration of the rays of the sun; it is also remarkably pure and free from organic particles, and it is also very still. The amount of bright sunshine, therefore, is large during the winter months, although the temperature in the shade is very low and snow abounds. The effect upon the human organism is essentially bracing, the altered density of the air leading to greater respiratory efforts, and so to a considerably increased gaseous interchange in the lung. The due oxygenation of the blood takes place even although considerable tracts of the pulmonary tissue are without respiratory function. It is almost always found that the appetite is increased, and all the functions of the body appear to be stimulated.

The bright sunshine for so many hours of a winter's day is of course the main advantage, and the extreme cold does not interfere with its enjoyment, as there is as a rule no wind. It thus follows that many of the out-of-door occupations, such as skating, tobogganing, and other similar amusements, and tennis and such like so-called summer exercises, may be indulged in with impunity with

the snow piled up many feet thick around and icicles hanging from the eaves of the houses.

The remarkable and very comforting fact is soon brought home to a person who has been in the habit of shutting himself up from every breath of cold, viz., that he may enjoy any amount of the sunshine in the open air without "catching cold." This cannot be done with safety at any of the other varieties of climatic health resort to anything like the same extent. Such being the case it is not a matter of great surprise that so many phthisical patients, whether their cases are suitable or not, flock year by year to these altitudes to spend the winter. As regards the cases which may be considered fit for this kind of climatic treatment there is some difference of opinion. In our opinion those who are likely to derive most benefit are the very early cases in which the tubercular lesion is small and not active. We have elsewhere laid it down as our opinion that cases of phthisis in which there is much fever should not be advised to leave home at all. It necesarily follows that early cases with fever should be excluded from this kind of treatment. The high altitude treatment is essentially suited for the young, and the best years are from 20 to 30. The old, or those beyond the age of 50, are not in our opinion proper subjects for this form of climate at all; their circulations at the best of times are too sluggish and the cold is too severe an experience. There is ample evidence to prove that many cases of early phthisis have been arrested or absolutely cured at Davos and such like places. We are very doubtful whether cases with extensive lesions should be sent to the high altitudes, even although the lesions are chronic or quiescent; but there is no doubt but that many of these cases do go there and are sometimes much benefited. It is only fair to say that cases in almost any stage short of the most advanced

have been reported as "relieved," "improved" or "arrested," but at the same time there are several conditions of phthisis to which the high altitude treatment has done much more harm than good. These ought to be borne in mind, and we may mention the most important. All those in whom the respiratory power is impaired by permanent diseased conditions, such as emphysema or atelectasis, should be dissuaded from attempting the high altitudes, as they are certain to cause a greatly increased effort of respiration which cannot be suffered with impunity. Then again persons with any serious defect of the circulatory system should be warned of the risk which they undergo. The mountain air is not suited to the excitable or nervous, nor yet to the other extreme of very depressed and lowered vitality, and the dry air is very irritating to inflammatory throat affections.

We must also remember that there are some persons who can never "stand cold," as they say, and these, even if suitable from other points of view and of proper age, should not be sent to the cold mountain air.

Prolonged residence is an essential if marked and permanent improvement is looked for, and patients going to the mountains for the first time should be sent before the heavy falls of snow occur, *i.e.*, in October, and should be advised to break their journey en route, *e.g.*, at Wiesen or the Maloja, both in going and returning.

Life in the Alpine health resorts has within the last ten years become much altered as regards general social conditions from what it was when the health-giving properties of the air of the altitudes first became recognized. Popularity has led to its inevitable result, crowding. Large hotels, theatres, ball-rooms, have arisen to meet the demand for amusement and luxury, and thus some of the very evils which the physician is the first to condemn, are

becoming a part of the daily round of the consumptive in search of health. The temptations to which he is exposed are daily increasing, and it becomes more than ever necessary for the medical adviser to keep him constantly reminded of the fact that he is an invalid, and cannot join in the round of amusements with the same impunity as the healthy man. The attractions of the altitude health resorts as social centres are yearly drawing more and more holiday makers who are not consumptive, and hot and stuffy rooms, late hours, and all the unhealthy surroundings of fashionable hotel life are liable to take the place of simplicity, fresh air and wholesome, if homely, dieting. The increase of smoke in the Davos Valley is in itself a serious element as materially detracting from one of the greatest attractions of the place, viz., the clearness and purity of the air during the daytime. There is, however, plenty of room both for the lovers of gaiety and for the seekers after pure air and a strictly hygienic life, if only the latter can be induced to keep clear of the fascinations of the former.

The rules that we have laid down elsewhere as to the daily life of patients in the different stages of the disease are as applicable to those who live in the mountains as to those who dwell in the plains.

Although the requisite conditions for high altitude treatment are at the present time most conveniently to be obtained at Davos or St. Moritz, it must not be supposed that it is in these regions alone that such conditions exist. Doubtless as time goes on, and the present altitude resorts become unpleasantly overcrowded, many other such places will be found in which all the same climatic conditions are present, and only the means of enjoying them require to be introduced. The opening up of the more mountainous parts of America has already

shown that the mountains of the West are as effective as those of Switzerland as places of residence for consumptives.

In the mountainous State of Colorado a number of larger or smaller health resorts have sprung up, all standing from 5,000 to 7,000 feet above sea level, and all subject in greater or less degree to the advantages which are claimed for the altitude resorts of the Engadine:—Low barometric pressure; dryness; clearness and absence of fog; sunshine; diathermancy; frequent air movement promoting evaporation and tempering solar heat; atmospheric electricity (Theodore Williams).

Each and all have their drawbacks as well as their advantages. In some the winds are excessive, in others the number of rainy days is considerable, and the daily variations of temperature more than the average. Hence it is most important in these, as in the better known places, to seek advice as to precautions in whatever locality may be selected. Denver City is the central point of the district, Manitou Springs and Colorado Springs lying due south. Manitou Springs is the usual starting-place for the many hotels and villas and pensions which have been established at various altitudes for the service of consumptive and other travellers.

The climate of Southern California is one of those which is particularly well suited to the consumptive who does not suffer from active forms of the disease. Los Angeles and Santa Barbara are the places best known and most employed for the purpose at the present time, but they should be regarded by European consumptives as places for permanent residence, and no patient should be allowed to look upon them in the same light as the health resorts of Switzerland, Egypt, or the Riviera, *i.e.*, as winter quarters only. The risks attendant upon the long

journey, whether it be by sea or by land, are out of all proportion to the possible good that might be obtained on a few months' visit to California. For young patients who can make up their minds to live permanently in the new country, and who have reasonable prospect of getting employment of some kind, this climate may very well be selected. Cases of chronic disease, with not too great destruction of the lungs, and with other organs sound, are the most favourable class, but no case should be sent to California unless there is distinct evidence that the disease in the lungs has shown a tendency to become quiescent or fibroid under favourable circumstances. In cases of frequent activity of the disease or recurrent hæmorrhage the prospects of improvement are not sufficiently great to warrant so long a banishment from home surroundings. For many months in the year a purely out-of-doors existence can be enjoyed either within short distance of the sea shore, or by means of long excursions into the mountains, living under canvas, but the patient whose disease is active or extensive is not any more likely to prolong his life under these circumstances than he would be in a less favoured climate nearer home. The best climate in the world will not cure consumption, but it may aid the patient to resist the disease if the morbid process has not yet got the upper hand. This fact cannot be too carefully borne in mind when the question of treatment in a far-distant country has to be decided.

We have now to allude briefly to what seem likely to come much to the front as health resorts for consumptive patients, viz., the districts of *Southern Africa.*

The potentialities of this country for the treatment of consumptives have only recently received attention. They are obviously very great. The country is so extensive that it would be absurd to make many general

remarks upon its climate, which obviously must vary enormously in different districts, but the chief advantages which are claimed for it are the following:—The average humidity of the air is much lower than that of England; the heat, even in the summer, is seldom or never unbearable; the rain, speaking generally, occurs in the summer and so tempers the heat, never produces a great amount of humidity, and as it occurs in storms and heavy showers passes off quickly in streams and rivers, and does not sink into the soil; it contains a considerable number of elevated table lands and mountains. The main drawbacks to the country are firstly the strong winds, south-easters about Cape Town, and occasional dust storms in the country, and next may be mentioned the sudden changes of temperature to which it is subject. The sun by day may be very hot, even in the cold months, but at night the temperature falls rapidly.

Many districts of the south of Africa are particularly recommended for consumptives. These places are to be reached from the three ports on the coast from which railways now proceed for long distances into the interior, viz., Cape Town on the extreme south-west, the first port touched at from England; Port Elizabeth, south-south-east, and East London, also south, but more eastward. Although the neighbourhood of the coast is suitable for the hot months, particularly as the higher lands behind may be easily reached if the weather becomes too hot for invalids, the interior is better for the winter months. From Cape Town the places said to be especially suitable are Ceres, 84 miles by rail and 10 by road from Cape Town, 1,700 feet above the sea (September to May); Beaufort West, further on the same line of railway; Graham's Town, 100 miles from Port Elizabeth, 1,700 feet above the sea level; Graaf Reinet, 200 miles from the same port;

Cradock, 180 miles from Port Elizabeth, 3,000 feet above sea level. Of all the districts, however, which have been so far investigated, there seems little doubt but that the Orange Free State affords the best climate for consumptives. It is a considerable country, and lies to the north-east of Cape Colony, and between the eastern part of it and the Transvaal. It is situated between the Orange and the Vaal rivers, and is under a Dutch Government. There are, however, many English settled within it. So much of the country is composed of grass land, almost devoid of trees, that it cannot be called a pretty country, but it has this advantage, that it is for all practical purposes an elevated plateau, lying from 4,000 to 5,000 feet above sea level, and has a very dry climate. The summer heat is considerable (maximum temperature 82 degrees), but the nights are balmy and enable the invalid to sleep with doors and windows open, or even in the open air. In the cold months the average temperature is about 66 degrees, and for the coldest 56 degrees, but the average minimum is about 34 degrees, and during the coldest month 24 degrees. Cold and dry nights are followed by warm, bright sunshiny days, and the humidity, in spite of the cold, averages only 66 per cent., as against 82 in England. Of the towns, Bloemfontein is the chief and the best known. The Orange Free State may be reached from Cape Town or from Port Elizabeth. The well-known town of Kimberley, on the border, is about 28 hours from Port Elizabeth and 36 from Cape Town, and Bloemfontein is just 110 miles from Kimberley. The southern frontier of the Orange State may also be reached from the port of East London *viâ* Aliwal North. Another small place, nearer to Kimberley than the capital, called Boshof, is also recommended. In this place, according to the report

of Dr. Watkins, "There is rarely a wet day in the whole year, the rain falling mostly in storms, and there is an almost complete absence of the steady, drizzling rain of which there is so much in England." The same authority states: "Of course no climate can be expected to effect cure in cases of advanced disease, with cavities in the lungs, dropsy, albuminuria, and so on; but I think I may say that even in advanced cases life has always been prolonged, and many who have come with the disease in a comparatively early condition have been apparently cured."

It may be added that Natal and the extensive country to the north, extending to, and including the Transvaal, are also recommended for phthisical patients. The Transvaal is of much the same elevation as the Orange State, but the climate is said to be moister. Of the better known places, Heidelberg, Pretoria, and Potchefstroom are picked out as most suitable for such patients. Of the claims of Natal to be considered a proper climate for consumptives, there seems to be some difference of opinion.

There is no doubt that in consequence of the great mineral wealth, the presence of gold, diamonds, etc., in these South African countries, we shall have a much better opportunity in the near future of making minute comparisons between the climate of one place and another as regards sunshine, rainfall, relative humidity, and the like; but even with the comparatively scanty materials we have at our disposal we may infer that the climatic advantages of South Africa are very extensive.

Patients who are considered fit subjects for the South African climate should leave England in September or October, and would then arrive at Cape Town after three weeks' voyage at the beginning of the South African

summer. They may spend some little time in the neighbourhood of this town (not in the town itself) or at Ceres, from which walking tours or mountain excursions may be made, and where they may stay until the end of March, or they may proceed to Kimberley after a month or two's stay at Ceres, from whence they may easily reach Bloemfontein or Boshof at which to winter. Returning during the following summer they may spend some months at Cradock until the end of April. From Cradock they may easily reach Port Elizabeth, from whence to proceed to England. They will then arrive home after nearly two years' absence.

South Africa differs from almost every European country in affording a reasonable hope to young consumptive patients that having found a climate which suits them they may make it their permanent home. Although even South Africa is not free from the universal complaint of overcrowding, there is plenty of scope for business and professional energy, even though it be hampered by the presence of quiescent pulmonary disease. There, as elsewhere, a certain amount of available capital is a necessity for the start, and this is a *sine qua non* for the consumptive, who must of necessity make his own health the first consideration. Very many patients who have gone out as invalids to the Cape have lived to become useful and wealthy members of society in the Colony.

In whatever part of the country the patient elects to live the necessity for abundant outdoor exercise and strictly regular habits of life, to which we have before alluded, are as necessary in South Africa as in England, and hence the larger towns are to be avoided if possible, and occupation sought in the smaller communities of the country districts.

The new and rising towns in the gold districts are not

suitable places of residence for consumptives until such time as their disease has become entirely quiescent, owing to the difficulty in obtaining the necessary physical comforts and mental rest.

We may most appropriately deal with *the Desert* as our last division of climates. Ever since the occupation of Egypt by the English the climate of the country has come to be more and more employed in the treatment of cases of chest disease. It is particularly suitable for chronic cases of phthisis, coupled with emphysema and chronic catarrh of the bronchi, and in bronchiectasis. It is unsuitable for the irritable type of phthisis, and especially for early cases with a tendency to fever and hæmorrhage. To enjoy to the utmost the effect of the desert climate in Egypt, a voyage in one of the comfortable houseboats on the Nile is recommended, as Cairo is itself too dusty and insanitary for a prolonged residence. Of the River Nile there are 800 miles available before the second cataract is reached, and from November to March the pure, dry, bracing air of the desert may be enjoyed with as much or as little physical exercise as may be desired. The nights are often cold and the chill at sundown is considerable, but with ordinary precautions no harm need result.

Both at Luxor and at Assouan there are good hotels and English physicians, and no lack of interests for patients of either sex. Although Cairo is not a suitable place of residence for consumptives, there are in its immediate neighbourhood two good hotels in the desert proper, the one* close to the Pyramids and the other at Helouan, about 14 miles south of the city, but connected with it by rail and telegraph. The latter place presents all the best fea-

* Mena House, within a drive of Cairo, with excellent accommodation and good well water.

tures of a desert health resort, but is not as yet made attractive to consumptive patients, although used a great deal by Germans and others suffering from chronic rheumatic affections.

The mineral springs of Helouan are rich in the chlorides and sulphates of soda and magnesia, and the place is at present more frequented on account of its mineral waters than on account of its climate.

About Cairo the cool season from November to May is said to have an average temperature of 57° F., but a good deal of really cold weather may be looked for in the mid-winter months. At Luxor and Assouan the cold weather (as low as 50°) only lasts for a few weeks in the middle of winter, after which the temperature rapidly rises. The air at these stations is intensely dry and hence malaria is unknown. During the summer months the heat is great, although tempered with a marked fall of temperature at night, as in all sub-tropical climates.

The following works may be consulted with advantage for useful information on the subject of the special features of the various climates and health resorts of which we have made mention :—

"Climate in the Cure of Lung Disease : Southern California."

"High Altitudes of Colorado." (C. Theodore Williams, M.D.)

"The Climatic Treatment of Consumption." (J. A. Lindsay, M.D.)

"The Principal Southern and Swiss Health Resorts." (W. Marcet, M.D.)

"Alpine Winter in its Medical Aspects." (A. Tucker Wise.)

"South Africa as a Health Resort." (Fuller and Symes Thompson.)

"The Voyage to South Africa and Sojourn there." (John Noble, editor.)

"Egypt as a Winter Resort." (F. M. Sandwith.)

"Climate and Health Resorts." (Burney Yeo.)

"Handbuch der Speciellen Klimatotherapie und Balneotherapie, mit besonderer Rücksicht auf Mittel Europa." (H. Reimer.)

"Systematisches Lehrbuch der Balneotherapie einschliesslich der Klimatotherapie der Phthisis." (J. Braun.)

"The Climates and Baths of Great Britain."

(Report of a Committee of the Royal Medical and Chirurgical Society of London.)

For information regarding the various lines of steamships conveying passengers to Australia or New Zealand, the advertisements in the daily London papers may be consulted, but, as we have already stated, it is not advisable either for the doctor to recommend or for the patient to select any particular line of ships without careful inquiry as to the actual accommodation afforded. This can be ascertained by inspection of plans in the various offices of the steamship companies, but far better by a personal inspection of the proposed ship or one of the same line in the docks where the cargo is being laden. Much disappointment may be saved thereby, and we would urge the necessity of it in every instance before a passage is finally taken.

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